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, 2022

OR

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

For the transition period from to

Commission File Number 001-36407

ALNYLAM PHARMACEUTICALS, INC.

(Exact Name of Registrant as Specified in Its Charter)

Delaware	**77-0602661**
(State or Other Jurisdiction of Incorporation or Organization)	***(I.R.S. Employer Identification No.)***

675 West Kendall Street, Henri A. Termeer Square Cambridge, MA 02142
(Address of Principal Executive Offices) (Zip Code)

Registrant's telephone number, including area code: (617) 551-8200

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

Title of Each Class	Trading Symbol(s)	Name of Each Exchange on Which Registered
Common Stock, $0.01 par value per share	**ALNY**	**The Nasdaq Stock Market LLC**

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

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

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

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

Indicate by check mark whether the registrant has submitted electronically 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. Yes ☑ No ☐

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements. ☐

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b). ☐

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

The aggregate market value of the registrant's common stock, $0.01 par value per share ("Common Stock"), held by non-affiliates of the registrant, based on the last sale price of the Common Stock at the close of business on June 30, 2022, was $17,596,044,220. For the purpose of the foregoing calculation only, all directors and executive officers of the registrant are assumed to be affiliates of the registrant.

At February 17, 2023, the registrant had 124,130,988 shares of Common Stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive proxy statement for its 2023 annual meeting of stockholders, which the registrant intends to file pursuant to Regulation 14A with the Securities and Exchange Commission not later than 120 days after the registrant's fiscal year end of December 31, 2022, are incorporated by reference into Part II, Item 5 and Part III of this Form 10-K.

ALNYLAM PHARMACEUTICALS, INC.
ANNUAL REPORT ON FORM 10-K
For the Year Ended December 31, 2022

TABLE OF CONTENTS

CAUTIONARY NOTE REGARDING FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K contains forward-looking statements within the meaning of the federal securities laws, Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. We intend these forward-looking statements to be covered by the safe harbor provisions for forward-looking statements contained in the Private Securities Litigation Reform Act of 1995 and are including this statement for purposes of complying with those safe harbor provisions. All statements other than statements of historical facts contained in this Annual Report on Form 10-K are forward-looking statements. In some cases, you can identify forward-looking statements by terminology such as "may," "will," "should," "could," "expects," "plans," "intends," "anticipates," "believes," "estimates," "predicts," "potential," "continue," or the negative of these terms or other comparable terminology. These forward-looking statements include, but are not limited to, statements about:

- our views with respect to the potential for approved and investigational RNAi therapeutics, including ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO, Leqvio® (inclisiran), fitusiran and zilebesiran;
- our plans for additional global regulatory filings and the continuing product launches of ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO and our partner's plans with respect to Leqvio;
- risks related to the direct or indirect impact of the novel coronavirus, or COVID-19, global pandemic, emerging or future variants of COVID-19 or any future pandemic, such as the scope and duration of the pandemic, government actions and restrictive measures implemented in response, the effectiveness of vaccination and booster vaccination campaigns, material delays in diagnoses of rare diseases, initiation or continuation of treatment for diseases addressed by our products, or in patient enrollment in clinical trials, potential clinical trial, regulatory review and inspection or supply chain disruptions, and other potential impacts to our business;
- our expectations regarding potential market size for, and the successful commercialization of, ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO, Leqvio or any future products;
- our ability to obtain and maintain regulatory approvals and pricing and reimbursement for ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO or any future products, and our partners' ability with respect to Leqvio and fitusiran;
- the progress of our research and development programs, including programs in both rare and prevalent diseases;
- our future ability to successfully expand the indications for ONPATTRO and AMVUTTRA;
- the potential for improved product profiles to emerge from our new technologies, including our IKARIA and GEMINI platforms and our ability to successfully advance our delivery efforts in extrahepatic tissues;
- our current and anticipated clinical trials and expectations regarding the reporting of data from these trials;
- any impact of the on-going conflict in Ukraine, including disruptions to our clinical trials;
- the timing of regulatory filings and interactions with or actions or advice of regulatory authorities, which may affect the design, initiation, timing, continuation and/or progress of clinical trials or result in the need for additional pre-clinical and/or clinical testing or the timing or likelihood of regulatory approvals;
- the status of our manufacturing operations and any delays, interruptions or failures in the manufacture and supply of ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO or any of our product candidates (or other products or product candidates being developed and commercialized by our partners), by our or their contract manufacturers or by us or our partners;
- our progress continuing to build and leverage global commercial infrastructure;
- the possible impact of any competing products on the commercial success of ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO and Leqvio, as well as our product candidates, and, our, or with respect to Leqvio or fitusiran, our partners', ability to compete against such products;
- our ability to manage our growth and operating expenses;
- our views and plans with respect to our 5-year *Alnylam P^{5}x25* strategy and our intentions to achieve the metrics associated with this strategy, including to become a top-tier biotech company by the end of 2025;
- our belief that our current cash balance should enable us to achieve a self-sustainable profile without the need for future equity financing;
- our expectations regarding the length of time our current cash, cash equivalents and marketable equity and debt securities will support our operations based on our current operating plan;
- our dependence on third parties for development, manufacture and distribution of products;

- our expectations regarding our corporate collaborations, including potential future licensing fees and milestone and royalty payments under existing or future agreements;
- our ability to obtain, maintain and protect our intellectual property;
- our ability to attract and retain qualified key management and scientists, development, medical and commercial staff, consultants and advisors and to successfully execute on our *Alnylam P*^{5}*x25* strategy;
- the outcome of litigation, including our patent infringement suits against Pfizer, Inc., BioNTech SE and Moderna, Inc., or other legal proceedings or of any current or future government investigation, including the investigation related to the subpoena received on or about April 9, 2021 pertaining to our marketing and promotion of ONPATTRO in the United States, or U.S.;
- regulatory developments in the U.S. and foreign countries;
- the impact of laws and regulations;
- developments relating to our competitors and our industry;
- our ability to satisfy our payment obligations, and to service the interest on or to refinance our indebtedness, including our convertible notes, or to make cash payments in connection with any conversion of the Notes, to the extent required;
- our expectations regarding the effect of the capped call transactions and regarding the anticipated market activities of the option counterparties and/or their respective affiliates; and
- other risks and uncertainties, including those listed under the caption Part I, Item 1A, "Risk Factors" of this Annual Report on Form 10-K.

The risks set forth above are not exhaustive. Other sections of this Annual Report on Form 10-K may include additional factors that could adversely affect our business and financial performance. Moreover, we operate in a very competitive and rapidly changing environment. New risk factors emerge from time to time and it is not possible for management to predict all risk factors, nor can we assess the impact of all risk factors on our business or the extent to which any factor, or combination of factors, may cause actual results to differ materially from those contained in any forward-looking statements. Any forward-looking statements in this Annual Report on Form 10-K reflect our current views with respect to future events and with respect to our business and future financial performance, and involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by these forward-looking statements. Factors that may cause actual results to differ materially from current expectations include, among other things, those described under Part I, Item 1A, "Risk Factors" and elsewhere in this Annual Report on Form 10-K. Given these uncertainties, you should not place undue reliance on these forward-looking statements. Except as required by law, we assume no obligation to update or revise these forward-looking statements for any reason, even if new information becomes available in the future. You are advised, however, to consult any further disclosure we make in our reports filed with the SEC.

This Annual Report on Form 10-K may include data that we obtained from industry publications and third-party research, surveys and studies. Industry publications and third-party research, surveys and studies generally indicate that their information has been obtained from sources believed to be reliable, although they do not guarantee the accuracy or completeness of such information. This Annual Report on Form 10-K also may include data based on our own internal estimates and research, including estimates regarding the impact of the COVID-19 pandemic (or related pandemic caused by coronavirus variants) on our financial statements and business operations. Our internal estimates have not been verified by any independent source and, while we believe any data obtained from industry publications and third-party research, surveys and studies are reliable, we have not independently verified such data. Such third-party data, as well as our internal estimates and research, are subject to a high degree of uncertainty and risk due to a variety of factors, including those described in Part I, Item 1A, "Risk Factors" and elsewhere in this Annual Report on Form 10-K. These and other factors could cause our results to differ materially from those expressed in this Annual Report on Form 10-K.

PART I

ITEM 1. BUSINESS

Overview

Alnylam Pharmaceuticals, Inc. (also referred to as Alnylam, we, our or us) is a global commercial-stage biopharmaceutical company developing novel therapeutics based on ribonucleic acid interference, or RNAi. RNAi is a naturally occurring biological pathway within cells for sequence-specific silencing and regulation of gene expression. By harnessing the RNAi pathway, we have developed a new class of innovative medicines, known as RNAi therapeutics. RNAi therapeutics are comprised of small interfering RNA, or siRNA, and function upstream of conventional medicines by potently silencing messenger RNA, or mRNA, that encode for proteins implicated in the cause or pathway of disease, thus preventing them from being made. We believe this is a revolutionary approach with the potential to transform the care of patients with rare and prevalent diseases. To date, our efforts to advance this revolutionary approach have yielded the approval of five first-in-class RNAi-based medicines, ONPATTRO® (patisiran), AMVUTTRA® (vutrisiran), GIVLAARI® (givosiran), OXLUMO® (lumasiran) and Leqvio® (inclisiran).

Our research and development strategy is to target genetically validated genes that have been implicated in the cause or pathway of human disease. We utilize a N-acetylgalactosamine (GalNAc) conjugate approach or lipid nanoparticle (LNP) to enable hepatic delivery of siRNAs. For delivery to the central nervous system, or CNS, and the eye (ocular delivery), we are utilizing an alternative conjugate approach based on a hexadecyl (C16) moiety as a lipophilic ligand. During 2022, we also advanced approaches for heart, skeletal muscle, and adipose tissue delivery of siRNAs. Our focus is on clinical indications where there is a high unmet need, a genetically validated target, early biomarkers for the assessment of clinical activity in Phase 1 clinical studies, and a definable path for drug development, regulatory approval, patient access and commercialization.

In early 2021, we launched our *Alnylam P^{5}x25* strategy, which focuses on our planned transition to a top-tier biotech company, as measured by market capitalization, by the end of 2025. With *Alnylam P^{5}x25*, we aim to deliver transformative rare and prevalent disease medicines for patients around the world through sustainable innovation, while delivering exceptional financial performance. Specifically, we intend to end 2025 with the following profile:

Patients: Over 0.5 million on our RNAi therapeutics globally
Products: Six or more marketed products in rare and prevalent diseases
Pipeline: Over 20 clinical programs, with 10 or more in late stages and four or more INDs per year
Performance: ≥40% revenue CAGR (compound annual growth rate) through YE 2025
Profitability: Achieve sustainable non-GAAP (generally accepted accounting principles) profitability within the period

We ended 2022 making meaningful progress on these goals, and currently have five marketed products and more than ten clinical programs, including several in late-stage development, across four Strategic Therapeutic Areas, or "STArs:" Genetic Medicines; Cardio-Metabolic Diseases; Hepatic Infectious Diseases; and CNS/Ocular Diseases. Four of our marketed products are within the Genetic Medicines STAr, ONPATTRO, GIVLAARI, OXLUMO and AMVUTTRA. ONPATTRO is approved by the United States Food and Drug Administration, or the FDA, for the treatment of the polyneuropathy of hereditary transthyretin-mediated amyloidosis, or hATTR amyloidosis, in adults and has also been approved in the European Union, or EU, for the treatment of hATTR amyloidosis in adult patients with stage 1 or stage 2 polyneuropathy, in Japan for the treatment of transthyretin, or TTR, type familial amyloidosis with polyneuropathy, and in multiple additional countries, including Brazil. In August 2022, we reported positive results from the APOLLO-B Phase 3 study of patisiran (the non-branded name of ONPATTRO) in patients with ATTR amyloidosis with cardiomyopathy, and in December 2022, we submitted a supplemental New Drug Application, or sNDA, to the FDA for ONPATTRO as a potential treatment of the cardiomyopathy of ATTR amyloidosis. In February 2023, the FDA accepted the sNDA for filing and set an action date of October 8, 2023 under the Prescription Drug User Fee Act, or PDUFA. The FDA also indicated in the sNDA filing communication letter that it is planning to hold an advisory committee meeting to discuss the application and that it had not identified any potential review issues at such time. GIVLAARI is approved in the U.S. for the treatment of adults with acute hepatic porphyria, or AHP, in the EU for the treatment of AHP in adults and adolescents aged 12 years and older, and in several additional countries, including Brazil, Canada, Switzerland and Japan. Regulatory filings for givosiran (the non-branded drug name for GIVLAARI) in other territories are pending or planned during 2023 and beyond. OXLUMO is approved in the U.S. and EU for the treatment of primary hyperoxaluria type 1, or PH1, in all age groups, and in several additional countries including Brazil and Switzerland. In October 2022, we announced that the FDA approved our sNDA for lumasiran (the non-branded drug name for OXLUMO), for the treatment of PH1 to lower urinary oxalate and plasma oxalate levels in pediatric and adult patients. Regulatory filings in other territories are pending and additional filings are planned during 2023 and beyond. In June 2022, we received regulatory approval for AMVUTTRA in the U.S. for the treatment of the polyneuropathy of hATTR amyloidosis in adults. In September 2022, AMVUTTRA was granted marketing authorization in Europe and the United Kingdom, or UK, for the treatment of hATTR amyloidosis in adult patients with stage 1 or stage 2 polyneuropathy, and in Japan for the treatment of TTR type familial amyloidosis with polyneuropathy. In December 2022, AMVUTTRA was approved in Brazil for the treatment of

hATTR amyloidosis in adults. Regulatory filings in other territories are currently under review and additional filings are planned for 2023.

Our fifth product, Leqvio (inclisiran), is being developed and commercialized by our partner Novartis AG, or Novartis, and has received marketing authorization from the European Commission, or EC, for the treatment of adults with hypercholesterolemia or mixed dyslipidemia and from the FDA as an adjunct to diet and maximally tolerated statin therapy for the treatment of adults with heterozygous familial hypercholesterolemia, or HeFH, or clinical atherosclerotic cardiovascular disease, or ASCVD, who require additional lowering of LDL-C. As of the end of January 2023, Leqvio has been approved in 70 countries.

In addition to our marketed products, we have multiple late-stage investigational programs advancing toward potential commercialization. These programs include our wholly owned programs: patisiran (the non-branded drug name for ONPATTRO) for the treatment of transthyretin amyloidosis, or ATTR amyloidosis, (wild-type or hereditary) with cardiomyopathy; vutrisiran (the non-branded drug name for AMVUTTRA) for the treatment of ATTR (wild-type or hereditary) amyloidosis with cardiomyopathy; as well as fitusiran for the treatment of hemophilia, which is being advanced by our partner Genzyme Corporation, a Sanofi Company, or Sanofi; and cemdisiran for the treatment of complement-mediated diseases, where our partner Regeneron Pharmaceuticals, Inc., or Regeneron, is advancing cemdisiran in combination with pozelimab in Phase 3 studies in myasthenia gravis and paroxysmal nocturnal hemoglobinuria.

As part of our *Alnylam P^{5}x25* strategy, we have multiple drivers of future growth, including the development of transformative prevalent disease medicines. In addition to Leqvio, we are advancing zilebesiran, an investigational, subcutaneously administered RNAi therapeutic targeting angiotensinogen, or AGT, in development for the treatment of hypertension. In November 2021, we reported positive interim data from the ongoing Phase 1 study of zilebesiran, and initiated the KARDIA Phase 2 clinical studies for zilebesiran. KARDIA-1 is designed to evaluate zilebesiran as a monotherapy across different doses administered quarterly and biannually. KARDIA-2 will evaluate the safety and efficacy of zilebesiran administered biannually as a concomitant therapy in patients whose blood pressure is not adequately controlled by a standard of care antihypertensive medication. Topline results from the KARDIA-1 and KARDIA-2 Phase 2 studies are anticipated in mid-2023 and at or around year-end 2023, respectively.

In further support of our *Alnylam P^{5}x25* strategy and in view of our evolving risk profile, we remain focused on the continued evolution of our global infrastructure, including key objectives such as optimizing our global structure for execution in key markets, enhancing performance consistent with our values, and continuing to strengthen our culture. We maintain focus on our global compliance program to drive its evolution and enhancement in view of the *Alnylam P^{5}x25* strategy. Building from our global Code of Business Conduct and Ethics, our compliance program is designed to empower our employees and those with whom we work to execute on our strategy consistent with our values and in compliance with applicable laws and regulations, and to mitigate risk. Comprised of components such as risk assessment and monitoring; policies, procedures, and guidance; training and communications; dedicated resources; and systems and processes supporting activities such as third party relationships and investigations and remediation; our program and related controls are built to enhance our business processes, structures, and controls across our global operations, and to empower ethical decision making.

Based on our expertise in RNAi therapeutics and broad intellectual property estate, we have formed alliances with leading pharmaceutical and life sciences companies to support our development and commercialization efforts, including Regeneron, Novartis (which acquired our partner The Medicines Company, or MDCO, in 2020), Sanofi, Vir Biotechnology, Inc., or Vir, Dicerna Pharmaceuticals, Inc. (acquired by Novo Nordisk A/S, or Novo Nordisk, in December 2021), or Dicerna, and PeptiDream, Inc., or PeptiDream.

Convertible Senior Notes

In September 2022, we issued $1.04 billion aggregate principal amount of 1.00% Convertible Senior Notes due 2027, or Notes. The Notes will mature on September 15, 2027, unless earlier converted, redeemed or repurchased. The Notes will bear interest from September 15, 2022 at a rate of 1.00% per year payable semiannually in arrears on March 15 and September 15 of each year, beginning on March 15, 2023. Before June 15, 2027, noteholders will have the right to convert their Notes in certain circumstances and during specified periods. From and after June 15, 2027, the Notes will be convertible at the option of the noteholders at any time prior to the close of business on the second scheduled trading day immediately preceding the maturity date. We will settle any conversions of Notes by paying or delivering, as applicable, cash shares of our common stock, par value $0.01 per share, or Common Stock, or a combination of cash and shares of Common Stock, at our election.

In connection with the issuance of the Notes, we paid $118.6 million, including expenses, to enter into privately negotiated capped call transactions with certain initial purchasers of the Notes or their respective affiliates and certain other financial institutions, or capped call transactions. The capped call transactions are expected generally to reduce the potential dilution upon conversion of the Notes in the event that the market price per share of our common stock, as measured under the terms of the capped call transactions, is greater than the strike price of the capped call transactions, which initially corresponds to the conversion price of the Notes, and is subject to anti-dilution adjustments generally similar to those applicable to the conversion rate of the Notes. The cap price of the capped call transactions will initially be $424.00 per share, which represents a premium of approximately 100% based on the last reported sale price of our common stock of $212.00 per share on September 12, 2022,

and is subject to certain adjustments under the terms of the capped call transactions. If, however, the market price per share of our common stock, as measured under the terms of the capped call transactions, exceeds the cap price of the capped call transactions, there would nevertheless be dilution upon conversion of the Notes to the extent that such market price exceeds the cap price of the capped call transactions.

We used approximately $762.0 million of the net proceeds from the offering to repay borrowings, inclusive of prepayment premiums, under our credit agreement with Blackstone, and intend to use the remainder of the net proceeds for general corporate purposes.

The COVID-19 Pandemic

The COVID-19 pandemic has resulted in the imposition of various responses, including government-imposed quarantines, travel restrictions, and other public health safety measures to reduce the spread of disease. We continue to closely monitor the spread of COVID-19 and its variants, and plan to continue taking steps to identify and mitigate the adverse impacts on, and risks to, our business posed by its spread and actions taken by governmental and health authorities to address the ongoing COVID-19 pandemic. The extent to which COVID-19 ultimately impacts our business, results of operations or financial condition will depend on future developments, which remain uncertain and cannot be predicted with confidence, such as the duration of the COVID-19 pandemic, new strains of the virus, including any future variants that may emerge, which may impact rates of infection and vaccination efforts, developments or perceptions regarding the safety of vaccines, and any additional preventative and protective actions taken to contain the pandemic or treat its impact, among others. The estimates of the impact on the Company's business may change based on new information that may emerge concerning COVID-19 and the actions to contain it or treat its impact and the economic impact on local, regional, national and international markets. For additional information related to the actual or potential impacts of COVID-19 on our business, please read Part I, Item 1A, "Risk Factors" of this Annual Report on Form 10-K.

Key 2022 and Recent Highlights

TTR Franchise

- ***ONPATTRO (patisiran) and AMVUTTRA (vutrisiran)– hATTR Amyloidosis with Polyneuropathy***
  - Achieved global net product revenues for ONPATTRO and AMVUTTRA for the full year 2022 of $558 million and $94 million, respectively
  - Attained over 2,975 hATTR amyloidosis patients with polyneuropathy worldwide on commercial treatment with ONPATTRO or AMVUTTRA as of December 31, 2022
  - Received 760 Start Forms in the U.S. for AMVUTTRA from launch through December 31, 2022
- ***Patisiran*** – ATTR Amyloidosis with Cardiomyopathy
  - Reported positive results from the APOLLO-B Phase 3 study in patients with ATTR amyloidosis with cardiomyopathy
  - Submitted and received acceptance of the sNDA for ONPATTRO (patisiran) for the treatment of the cardiomyopathy of ATTR amyloidosis
    - The FDA has set an action date of October 8, 2023 under the PDUFA
    - In their file acceptance letter, the FDA stated that they have not identified any review issues, and also noted that they are planning to hold an advisory committee meeting to discuss the application
- ***Vutrisiran*** – hATTR Amyloidosis with Polyneuropathy
  - Received FDA approval of AMVUTTRA for the treatment of the polyneuropathy of hATTR amyloidosis in adults
  - Received marketing authorization for AMVUTTRA for the treatment of hATTR amyloidosis in adults with stage 1 or stage 2 polyneuropathy in Europe and the UK, as well as approval for TTR type familial amyloidosis with polyneuropathy in Japan
  - Received approval from the Brazilian Health Regulatory Agency (ANVISA) for AMVUTTRA for the treatment of hATTR amyloidosis in adults
- ***Vutrisiran*** – ATTR Amyloidosis with Cardiomyopathy
  - Announced that we do not plan to conduct the optional interim analysis for the HELIOS-B Phase 3 study in patients with ATTR amyloidosis with cardiomyopathy; the study remains on track for topline results in early 2024

Commercial/Late-Stage Pipeline

- ***GIVLAARI (givosiran) – Acute Hepatic Porphyria***
  - Recognized GIVLAARI global net revenue of $173.1 million for the year ended December 31, 2022
  - Attained over 520 patients worldwide on commercial GIVLAARI treatment as of December 31, 2022
- ***OXLUMO (lumasiran) – Primary Hyperoxaluria Type 1***
  - Recognized OXLUMO global net revenue of $69.8 million for the year ended December 31, 2022
  - Attained over 280 patients worldwide on commercial OXLUMO treatment as of December 31, 2022, up from over 230 commercial patients as of September 30, 2022
- ***Leqvio (inclisiran) – Hypercholesterolemia (in collaboration with Novartis)***
  - Our partner, Novartis, continued the launch of Leqvio, with focus on patient on-boarding, removing access hurdles and enhancing medical education
- ***Lumasiran – Primary Hyperoxaluria Type 1***
  - Based on the successful outcome of the ILLUMINATE-C study in children and adults with advanced PH1, received approval from the FDA of an sNDA for OXLUMO, expanding the indication for the treatment of PH1 to lower urinary oxalate and plasma oxalate levels in pediatric and adult patients, and received approval from the EMA of a Type II variation to include the ILLUMINATE-C data in the label

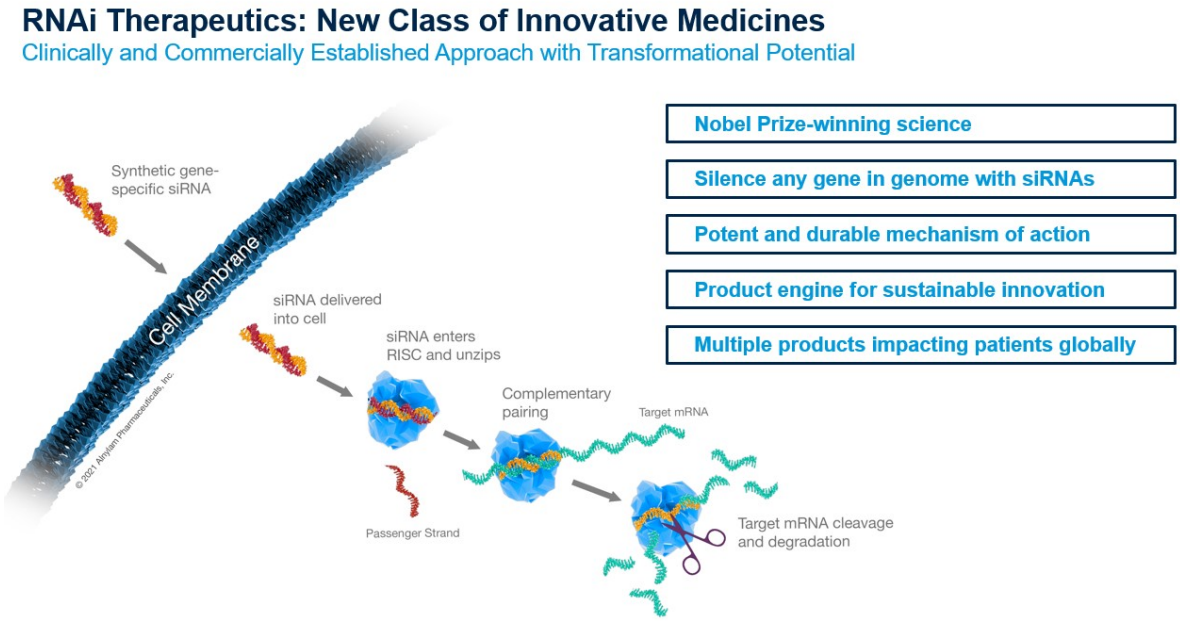
Early-Stage and Pre-Clinical Pipeline

- ***Zilebesiran (ALN-AGT)*** for the treatment of hypertension; completed enrollment in the KARDIA-1 Phase 2 monotherapy study of zilebesiran in patients with mild-to-moderate hypertension
- ***ALN-APP*** for the treatment of cerebral amyloid angiopathy and autosomal dominant Alzheimer's Disease; enrollment and dose escalation continue in the Phase 1 study of ALN-APP in patients with early onset Alzheimer's Disease, in collaboration with Regeneron, with initial topline results expected in early 2023
- ***ALN-TTRsc04*** for the treatment of ATTR amyloidosis; submitted a CTA application and initiated dosing in a Phase 1 study

Corporate Highlights

- ***Finance***
  - Ended 2022 with $2.19 billion in cash, cash equivalents and marketable securities
- ***Business***
  - Issued $1.04 billion convertible senior notes with proceeds primarily used to pay down Blackstone $700 million credit facility and approximately $200 million in prepayment premiums under the credit facility, the purchase of capped call transactions, and underwriter fees

RNAi Therapeutics – A New Class of Innovative Medicines



Overview of RNAi Therapeutics

In recent years, a tremendous amount of progress has been made in effectively delivering RNAi therapeutics to targeted organs and cells, and we believe Alnylam has been the leader of this advancement. We believe this success will enable us to achieve our *Alnylam P*^{5}*x25* strategy under which we expect to sustainably and organically create and commercialize transformative rare and prevalent disease medicines benefiting patients around the world while delivering strong financial performance, resulting in a leading biotech profile by the end of 2025.

Early efforts focused on delivery of RNAi therapeutics utilizing LNPs, where siRNA molecules are encapsulated in specific lipid-based formulations. This technology enables systemic delivery with intravenous drug administration and is associated with potent, rapid and durable target gene silencing and an encouraging tolerability profile in clinical studies conducted to date, as well as in our commercial experience. Our first commercial product, ONPATTRO, is formulated utilizing LNPs.

In parallel, we have advanced proprietary technology that conjugates a sugar molecule called GalNAc to the siRNA molecule. This simpler delivery approach enables more convenient, subcutaneous administration of our drug candidates directed to liver expressed target genes, a key aspect of our platform. Results from our Enhanced Stabilization Chemistry, or ESC, GalNAc-conjugate delivery platform have demonstrated a durability of effect that we believe, based on our clinical results, supports once-monthly, once-quarterly, and potentially, bi-annual subcutaneous dose regimens. Due to this increased potency and durability, as well as a wide therapeutic index, this conjugate platform has become our primary approach for drug development and is leveraged and we believe, strongly validated by, AMVUTTRA, GIVLAARI, OXLUMO, and Leqvio, our more recently approved medicines. Our next generation Enhanced Stabilization Chemistry-Plus, or ESC+, GalNAc-conjugates utilize advanced design features to further improve specificity, while maintaining potency and durability, further improving our already wide therapeutic index by up to six-fold. Our first wave of investigational RNAi therapeutics based on this ESC+ design, zilebesiran (formerly ALN-AGT), ALN-HBV02 and ALN-HSD are in the clinic, with what we believe are encouraging initial results.

Our platform enhancements have also provided a strong foundation for pursuing a conjugate-based approach to extrahepatic delivery, including delivery to the brain and spinal cord, as well as ocular delivery. In July 2022, our publication in *Nature Biotechnology* showcased data utilizing an alternative conjugate approach based on a hexadecyl (C16) moiety as a lipophilic ligand, with proof-of-concept, or POC, demonstrated in rodent and non-human primates. C16 conjugates provide robust CNS knockdown with wide biodistribution and long duration of action, and this technology enabled our landmark collaboration with Regeneron for the advancement of RNAi therapeutics for a broad range of diseases by addressing therapeutic targets in the eye and CNS, in addition to a select number of targets in the liver. We are continuing to advance other extrahepatic delivery approaches, including delivery to muscle and adipose cells. In addition, we are exploring peptide and antibody-based approaches for targeted siRNA delivery to new tissues in partnership with PeptiDream to discover and develop peptide-siRNA conjugates for targeted delivery of RNAi therapeutics to a broader range of extrahepatic tissues.

Additional platform advancements that we are working on include our IKARIA™ platform harboring chemistry innovations that enable robust target knockdown with an annual dosing regimen, and an additional technology platform, GEMINI™, that we believe has the potential to simultaneously silence two unique gene transcripts using a single chemical entity. We believe that these platforms, could have potential applications in cardiometabolic, CNS, oncologic, and viral diseases.

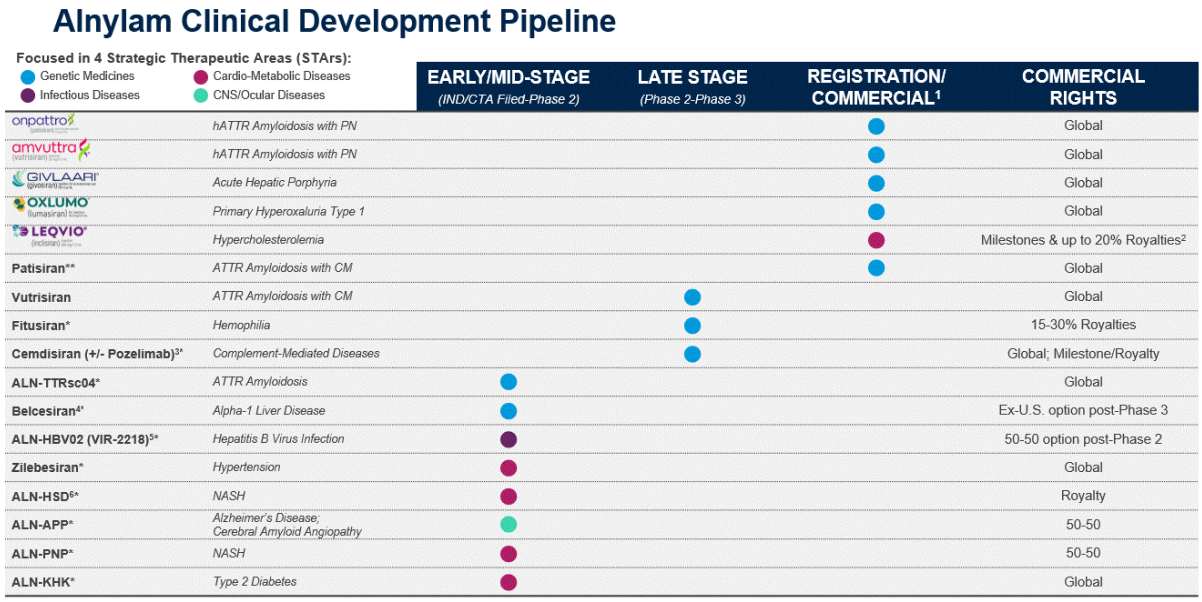
Finally, we continue to leverage human genetics to advance our efforts to bring innovative medicines to patients. We have established a relationship with the UK BioBank to support the sourcing of novel, genetically validated targets and secure access to databases of genetic information. In 2022, we published a manuscript in *Nature Communications,* revealing that loss of function variants in the hepatokine gene INHBE protect against abdominal obesity and can thus serve as a potential therapeutic target for cardiometabolic disease. The discovery leveraged sequencing data from more than 360,000 individuals in the UK Biobank. In addition, our partnership with Our Future Health furthers our investment in human genetics supporting the design and delivery of the research program to recruit up to five million adults from across the UK. Coupled with our proven ability to uncover novel gene targets, we believe our approach, investments and commitment to genetically validated targets has the potential to increase our success rate, streamline clinical trials and speed the development of precision medicines for patients with both rare and prevalent diseases.

We believe RNAi therapeutics represent a simplified and efficient new class of innovative medicines. We have achieved human POC in multiple clinical trials of our investigational candidates and now have five commercially approved products, validating our approach to drug development. Moreover, we believe that our reproducible and modular platform will support our *Alnylam P^{5}x25 s*trategy under which we expect to sustainably and organically create and commercialize transformative rare and prevalent disease medicines benefiting patients around the world while delivering strong financial performance, resulting in a leading biotech profile by the end of 2025.

Our Product Pipeline

Our broad pipeline, including five approved products and multiple late and early-stage investigational RNAi therapeutics, is focused in four STArs: Genetic Medicines; Cardio-Metabolic Diseases; Hepatic Infectious Diseases; and CNS/Ocular Diseases. We describe our commercial and clinical-stage pipeline in more detail below. The investigational therapeutics described below are in various stages of clinical development and the scientific information included about these therapeutics is preliminary and investigative. None of these investigational therapeutics have been approved by the FDA, EMA, or any other health authority and no conclusions can or should be drawn regarding the safety or efficacy of these investigational therapeutics.

The chart below is a summary of our commercial products and late- and early-stage development programs as of January 31, 2023. It identifies those programs for which we have received marketing approval, the stage of our programs and our commercial rights to such programs:



[1] Includes marketing application submissions; [2] Novartis has obtained global rights to develop, manufacture and commercialize inclisiran; 50% of inclisiran royalty revenue from Novartis will be payable to Blackstone by Alnylam; [3] Alnylam and Regeneron are evaluating potential combinations of the investigational therapeutics cemdisiran and pozelimab; [4] Dicerna is leading and funding development of belcesiran; [5] Vir is leading and funding development of ALN-HBV02; [6] Regeneron is leading and funding development of ALN-HSD; * Not approved for any indication and conclusions regarding the safety or efficacy of the drug have not been established; ** U.S. sNDA accepted; PDUFA Oct. 8, 2023.

As indicated in the chart above, to date we have received marketing approval for ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO, and Novartis has received approval for Leqvio, in each case in certain territories for the specific indications approved in each such territory, with additional regulatory submissions pending.

Our TTR Franchise

About Transthyretin Amyloidosis (ATTR)

ATTR amyloidosis is a rare, serious, life-threatening, multisystem disease encompassing hATTR amyloidosis and wild-type ATTR, or wtATTR, amyloidosis, which result from either hereditary (genetic variant in TTR gene) or nonhereditary (ageing) causes, respectively. In ATTR amyloidosis, misfolded TTR proteins accumulate as amyloid fibrils in multiple organs and tissue types. hATTR amyloidosis can include sensory and motor neuropathy, autonomic neuropathy and cardiac symptoms and is a major unmet medical need with significant morbidity and mortality, affecting approximately 50,000 people worldwide. The median survival is 4.7 years following diagnosis, with a reduced survival (3.4 years) for patients presenting with cardiomyopathy. wtATTR amyloidosis predominantly manifests as cardiomyopathy and heart failure symptoms, although patients may experience other manifestations due to extra-cardiac amyloid deposition. The disease is estimated to impact 200,000 to 300,000 people worldwide.

***ONPATTRO* (*patisiran*)**

ONPATTRO (patisiran) is an intravenously administered RNAi therapeutic targeting TTR. It is designed to target and silence TTR mRNA, thereby reducing the production of TTR protein before it is made. ONPATTRO blocks the production of TTR in the liver, reducing its accumulation in the body's tissues to halt or improve the progression of disease.

Patisiran has received Orphan Drug Designations in the U.S., EU and Japan; specific Orphan Drug Designations vary by country/region.

ONPATTRO (patisiran) – hATTR Amyloidosis with Polyneuropathy

ONPATTRO is the first ever FDA-approved RNAi therapeutic and based on data from the APOLLO Phase 3 study, it became our first product to receive marketing approval. In the U.S. and Canada, ONPATTRO is indicated for the treatment of the polyneuropathy of hATTR amyloidosis in adults. In the EU, Switzerland, Brazil and Israel, ONPATTRO is indicated for the treatment of hATTR amyloidosis in adults with stage 1 or stage 2 polyneuropathy, and in Japan, ONPATTRO is indicated for the treatment of TTR type familial amyloidosis with polyneuropathy.

Patisiran (the non-branded name for ONPATTRO) was also evaluated in a Phase 4 study in patients with polyneuropathy of hATTR amyloidosis due to a T60A or V122I variant. The data were presented in September 2022 at the 18th International Symposium on Amyloidosis.

Patisiran – ATTR Amyloidosis with Cardiomyopathy

In December 2022, we submitted an sNDA to the FDA for ONPATTRO for the treatment cardiomyopathy of ATTR amyloidosis based on the positive results from the APOLLO-B Phase 3 study. In February 2023, the sNDA was accepted for filing and the FDA set an action date of October 8, 2023 under the PDUFA. The FDA also indicated in the sNDA filing communication letter that it is planning to hold an advisory committee meeting to discuss the application and that it had not identified any potential review issues at such time. An sNDA submission is also planned in Brazil in 2023, however, we do not plan to pursue label expansion in other regions.

APOLLO-B Phase 3 Study

In September 2019, we initiated APOLLO-B, a randomized, double-blind, placebo-controlled Phase 3 study designed to evaluate the efficacy and safety of patisiran in patients with ATTR amyloidosis with cardiomyopathy. The study enrolled 360 adult patients with ATTR amyloidosis (hereditary or wild-type) with cardiomyopathy at 69 sites in 21 countries. Patients were randomized 1:1 to receive 0.3 mg/kg of patisiran or placebo intravenously administered every three weeks over a 12-month treatment period. Twenty-five percent of patients enrolled were receiving on-label commercially available tafamidis at baseline. After 12 months of treatment, the primary endpoint of change from baseline in six-minute walk test, or 6-MWT, was evaluated, as well as other secondary and exploratory endpoints.

- *Efficacy and Safety Results:*

  In August 2022, we announced positive topline results from the APOLLO-B study and in September 2022 we reported more fulsome results at the 18th International Symposium on Amyloidosis, announcing that APOLLO-B met the primary endpoint of change from baseline in the 6-MWT at 12 months compared to placebo with a median difference of 14.7 meters (p-value 0.0162) favoring patisiran. The study also met its first secondary endpoint, demonstrating a statistically significant and clinically meaningful benefit on health status and quality of life, as measured by the Kansas City Cardiomyopathy Questionnaire Overall Summary score, compared to placebo with least squares mean difference of 3.7 points (p-value 0.0397) favoring patisiran. The study also included additional secondary composite outcomes endpoints. A non-significant result (p-value 0.0574) was found on the composite endpoint of all-cause mortality, frequency of cardiovascular events, and change from baseline in 6-MWT over 12 months compared to placebo. As a result, formal statistical testing was not performed on the final two composite endpoints. During the 12 month placebo-controlled primary analysis period, patisiran also demonstrated an encouraging safety and tolerability profile in patients with ATTR amyloidosis with cardiomyopathy, including no cardiac safety concerns relative to placebo. The majority of adverse events, or AEs, were mild or moderate in severity. Treatment emergent AEs occurring in 5% or more patients in the patisiran group and observed at least 3% more commonly than in the placebo group included infusion-related reactions (12.2% vs 9.0%), arthralgia (7.7% vs 4.5%), and muscle spasms (6.6% vs 2.2%). In the safety analysis there were 5 deaths (2.8%) observed in patisiran-treated patients and 8 deaths (4.5%) observed in the placebo group. The safety profile in APOLLO-B was consistent with what was observed in our Phase 3 APOLLO study and in postmarketing use of ONPATTRO. Based on these positive data, in December 2022, we submitted an sNDA to the FDA for ONPATTRO for the treatment of the cardiomyopathy of ATTR amyloidosis.

AMVUTTRA (vutrisiran)

AMVUTTRA (vutrisiran) is a subcutaneously administered RNAi therapeutic targeting TTR. It is designed to target and silence TTR mRNA, thereby reducing the production of TTR protein before it is made. AMVUTTRA utilizes our ESC+ delivery platform, designed for increased potency and high metabolic stability to allow for quarterly subcutaneous administration.

Vutrisiran has received Orphan Drug Designation in the U.S., EU and Japan; specific Orphan Drug Designations vary by country/region.

AMVUTTRA (vutrisiran) – hATTR Amyloidosis with Polyneuropathy

In June 2022, AMVUTTRA was approved by the FDA for the treatment of the polyneuropathy of hATTR amyloidosis in adults based on positive 9-month results from the HELIOS-A Phase 3 study that evaluated the efficacy and safety of AMVUTTRA in patients with hATTR amyloidosis with polyneuropathy. In September 2022, AMVUTTRA was approved in the EU and UK for the treatment of hATTR amyloidosis in adult patients with stage 1 or stage 2 polyneuropathy, and in Japan for the treatment of TTR type familial amyloidosis with polyneuropathy. In December 2022, AMVUTTRA was approved in Brazil for the treatment of hATTR amyloidosis in adults. Regulatory filings in other territories are currently under review and additional filings are planned for 2023.

HELIOS-A Phase 3 Study

Initiated in late 2018, the HELIOS-A Phase 3 trial is a randomized, open-label Phase 3 study in hATTR amyloidosis patients. The study enrolled 164 patients with hATTR amyloidosis with polyneuropathy at 57 sites in 22 countries. Patients were randomized 3:1 to receive either a 25 mg subcutaneous injection of vutrisiran once every three months or 0.3 mg/kg intravenous infusion of patisiran once every three weeks as a reference comparator for 18 months. The primary endpoint is the mean change from baseline in the modified Neuropathy Impairment Score +7, or mNIS+7, at nine months as compared to the external placebo control arm of the previously completed APOLLO Phase 3 study of patisiran, upon which the approval of ONPATTRO was based. The two secondary endpoints at nine months were changes in quality of life assessed by the Norfolk Quality of Life Questionnaire-Diabetic Neuropathy, or Norfolk QoL-DN, score and gait speed assessed by the timed 10-meter walk test, both compared to external placebo. Changes from baseline in NT-proBNP were evaluated as an exploratory endpoint at nine months. Additional secondary and exploratory endpoints were evaluated at 18 months. In addition, following the 18-month treatment period, all patients were eligible to receive vutrisiran for an additional 18 months as part of the randomized treatment extension where they were randomized to receive either 25mg vutrisiran once quarterly or 50mg vutrisiran once every six months.

- *Efficacy and Safety Results:*

  At 9 months, vutrisiran met primary and all secondary endpoints, with statistically significant improvements in neuropathy, quality of life (QoL), and gait speed, relative to placebo.

In February 2023, we reported topline results from the HELIOS-A randomized treatment extension, or RTE, portion of the study, through month 9. Non-inferiority of the 50mg biannual regimen (vs 25mg quarterly) was established, as demonstrated by mean serum TTR reduction over 9 months. Vutrisiran also continued to demonstrate an acceptable safety profile. In the RTE study there were 6 deaths, of which 5 occurred on the 50 mg biannual arm and 1 occurred on the 25 mg quarterly arm, after the patient dropped out of the study. None was considered related to study drug. We also announced a strategic decision not to pursue regulatory submissions with the biannual dosing data given the dynamics of serum TTR recovery observed toward the end of the biannual dosing interval, the strong commercial performance of the existing vutrisiran 25mg quarterly regimen, and the opportunity to focus on continued innovation with ALN-TTRsc04.

Vutrisiran – ATTR Amyloidosis with Cardiomyopathy

Vutrisiran is also in development as a potential treatment for patients with ATTR amyloidosis with cardiomyopathy in the ongoing HELIOS-B Phase 3 study.

HELIOS-B Phase 3 Study

The HELIOS-B Phase 3 trial, initiated in late 2019, is a randomized, double-blind, placebo-controlled, multicenter study to evaluate the efficacy and safety of vutrisiran in patients with ATTR amyloidosis (wild-type or hereditary) with cardiomyopathy. Patients were randomized on a 1:1 basis to receive 25 mg of vutrisiran or placebo administered as a subcutaneous injection once every three months for up to 36 months. The primary endpoint will evaluate the efficacy of vutrisiran versus placebo on the composite endpoint of all-cause mortality and recurrent cardiovascular events at 30 months. Additional secondary and exploratory endpoints will also be evaluated. Concomitant use of on-label commercially available tafamidis is not prohibited. The study protocol includes an optional interim efficacy analysis to be conducted at our discretion. In August 2021, we announced full patient enrollment in the HELIOS-B study. Enrollment was completed significantly ahead of schedule, with 655 ATTR amyloidosis patients across 123 activated sites in 33 countries. In October 2022, we announced that we do not plan to conduct the optional interim analysis for the HELIOS-B Phase 3 trial. Topline results from the HELIOS-B study are expected in early 2024.

Vutrisiran – Stargardt Disease

In late 2022, we announced that we would not initiate a Phase 3 study of vutrisiran in Stargardt Disease by year-end, as previously communicated, as we continue to evaluate the impact of the Inflation Reduction Act.

Our Other Marketed Products

GIVLAARI (givosiran) — Acute Hepatic Porphyria (AHP)

Our RNAi therapeutic, GIVLAARI (givosiran), is the world's first-ever GalNAc-conjugate RNA therapeutic to be approved. GIVLAARI works by specifically reducing induced liver aminolevulinic acid synthase 1 mRNA, leading to

reduction of toxins associated with attacks and other disease manifestations of AHP. In the U.S., GIVLAARI (givosiran) injection for subcutaneous use is approved for the treatment of adults with AHP. GIVLAARI was reviewed by the FDA under Priority Review and had previously been granted Breakthrough Therapy and Orphan Drug Designations in the U.S. In March 2020, the EC granted marketing authorization in the EU for GIVLAARI for the treatment of AHP in adults and adolescents aged 12 years and older. GIVLAARI was reviewed under accelerated assessment by the EMA and had previously been granted PRIME and Orphan Drug Designations in the EU. We received additional marketing authorizations for GIVLAARI for the treatment of AHP in adults in Brazil, Canada, and marketing authorizations for GIVLAARI for the treatment of AHP in adults and adolescents in Japan, Argentina, Switzerland and Taiwan. We have also filed for regulatory approval for givosiran (the non-branded drug name for GIVLAARI) in Israel, Colombia and Australia, and additional regulatory filings are pending or planned in 2023 and beyond.

AHP refers to a family of ultra-rare, genetic diseases characterized by potentially life-threatening attacks and, for some patients, chronic manifestations that negatively impact daily functioning and quality of life. AHP is comprised of four types: acute intermittent porphyria, hereditary coproporphyria, variegate porphyria, and aminolevulinic acid dehydratase-deficiency porphyria. We estimate there are approximately 3,000 AHP patients diagnosed in the U.S. and EU with active disease. Each type of AHP results from a genetic defect leading to deficiency in one of the enzymes of the heme biosynthesis pathway in the liver. AHP disproportionately impacts women of working and childbearing age, and symptoms of the disease vary widely. Severe, unexplained abdominal pain is the most common symptom, which can be accompanied by limb, back or chest pain, nausea, vomiting, confusion, anxiety, seizures, weak limbs, constipation, diarrhea, or dark or reddish urine. The nonspecific nature of AHP signs and symptoms can often lead to misdiagnoses of other more common conditions such as viral gastroenteritis, irritable bowel syndrome and appendicitis. Consequently, patients with AHP can wait up to 15 years for a confirmed diagnosis. In addition, long-term complications and comorbidities of AHP can include hypertension, chronic kidney disease, or liver disease including hepatocellular carcinoma.

OXLUMO (lumasiran)— Primary Hyperoxaluria Type 1 (PH1)

OXLUMO is an RNAi therapeutic targeting hydroxyacid oxidase 1, or HAO1, developed for the treatment of PH1. HAO1 encodes glycolate oxidase, or GO, an enzyme upstream of the disease-causing defect in PH1. OXLUMO works by degrading HAO1 mRNA and reducing the synthesis of GO, which inhibits hepatic production of oxalate, the toxic metabolite responsible for the clinical manifestations of PH1. OXLUMO utilizes our ESC-GalNAc-conjugate technology, which enables subcutaneous dosing with increased potency and durability and a wide therapeutic index.

In November 2020, the EC granted marketing authorization for OXLUMO (lumasiran) for the treatment of PH1 in all age groups, following a positive Committee for Medicinal Products for Human Use, or CHMP, opinion. OXLUMO was previously granted an Accelerated Assessment and a PRIME Designation by the EMA and an Orphan Designation in the EU. Also, in November 2020, OXLUMO (lumasiran) subcutaneous injection was approved by the FDA for the treatment of PH1 to lower urinary oxalate levels in pediatric and adult patients. OXLUMO was reviewed by the FDA under Priority Review and had previously been granted Breakthrough Therapy, Orphan Drug, and Rare Pediatric Disease Designations. With the approval of OXLUMO, the FDA granted us a pediatric rare disease priority review voucher that entitles us to designate a single new drug application to qualify for a priority review in the future. During 2021 and 2022, we received additional marketing authorizations for OXLUMO in Brazil, the UK, Switzerland, Canada and Israel, and regulatory filings in other territories are pending and additional filings are planned for 2023 and beyond.

PH1 is an ultra-rare genetic disease that affects an estimated one to three individuals per million in the U.S. and Europe. PH1 is characterized by oxalate overproduction in the liver. The excess oxalate results in the deposition of calcium oxalate crystals in the kidneys and urinary tract and can lead to the formation of painful and recurrent kidney stones and nephrocalcinosis. Renal damage is caused by a combination of tubular toxicity from oxalate, calcium oxalate deposition in the kidneys, and urinary obstruction by calcium oxalate stones. PH1 is associated with a progressive decline in kidney function, which exacerbates the disease as the excess oxalate can no longer be effectively excreted, resulting in subsequent accumulation and deposition of oxalate in bones, eyes, skin, and heart, leading to severe illness and death. Management options prior to availability of OXLUMO were limited to hyperhydration, crystallization inhibitors and, in a minority of patients with a specific genotype, pyridoxine (vitamin B6). These measures do not adequately address oxalate overproduction but instead help to delay inevitable progression to kidney failure and the need for intensive dialysis as a bridge to a dual or sequential liver/kidney transplant. Liver transplantation is the only intervention that addresses the underlying metabolic defect, but is associated with high morbidity and mortality, and life-long immunosuppression. Prior to the approval of OXLUMO, there were no approved pharmaceutical therapies for PH1.

The regulatory approvals of OXLUMO in the U.S. and EU were based on positive results from both the ILLUMINATE-A and ILLUMINATE-B Phase 3 pivotal studies of lumasiran in patients with PH1. Lumasiran was also evaluated in ILLUMINATE-C – a global Phase 3 study in PH1 patients of all ages with advanced PH1. Based on the positive six-month efficacy and safety results of this study, in October 2022, we announced that the FDA approved a label expansion for OXLUMO, which is now indicated for the treatment of PH1 to lower urinary oxalate and plasma oxalate levels in pediatric and adult patients. In addition, the CHMP of the EMA delivered a positive opinion recommending variation to the marketing authorization of OXLUMO based on ILLUMINATE-C data from patients with advanced PH1 in September 2022.

In December 2022, we announced that we discontinued the proof-of-concept Phase 2 study of lumasiran in patients with recurrent kidney stone disease that was initiated in December 2021 due to lower than anticipated levels of elevated urinary oxalate in that patient population.

Leqvio (inclisiran) — Hypercholesterolemia

Our RNAi therapeutic Leqvio, developed and commercialized by our partner, Novartis, is the first and only siRNA therapy (or RNAi therapeutic) to lower low-density lipoprotein cholesterol (also known as "bad cholesterol" or LDL-C), and is the first RNAi therapeutic approved for a highly prevalent disease. Leqvio is a subcutaneously administered RNAi therapeutic targeting proprotein convertase subtilisin/kexin type 9, or PCSK9, to reduce LDL-C levels via an RNAi mechanism of action and could help improve outcomes for patients with ASCVD, a deadly form of cardiovascular disease. In December 2020, following a positive CHMP opinion, the EC granted marketing authorization for Leqvio (inclisiran) for the treatment of adults with primary hypercholesterolemia (heterozygous familial and non-familial) or mixed dyslipidemia, as an adjunct to diet: in combination with a statin or statin with other lipid-lowering therapies in patients unable to reach LDL-C goals with the maximally tolerated dose of a statin, or alone or in combination with other lipid-lowering therapies in patients who are statin-intolerant, or for whom a statin is contraindicated. In December 2021, the FDA approved Leqvio as an adjunct to diet and maximally tolerated statin therapy for the treatment of adults with HeFH or clinical ASCVD who require additional lowering of LDL-C. Leqvio has also been granted Orphan Drug Designation in the U.S. for the treatment of homozygous familial hypercholesterolemia, or HoFH. As of the end of January 2023, Leqvio has been approved in 70 countries.

Approximately 100 million people worldwide are treated with lipid lowering therapies, predominantly statins, to reduce LDL-C and the associated risk of death, nonfatal myocardial infarction and nonfatal stroke or associated events. However, residual risk for cardiovascular events remains and statins are associated with well-known limitations. First, not all subjects reach LDL-C levels associated with optimal protection against clinical events. Second, not all subjects tolerate statins or are able to take statins at sufficiently-intensive doses. Third, observational studies have demonstrated that >50% of patients do not adhere to statin therapy for more than six months. Despite statins alone or in combination with other lipid lowering medications, current therapies for the management of elevated LDL-C remain insufficient in some subjects. This is particularly true in patients with pre-existing coronary heart disease and/or diabetes or a history of familial hypercholesterolemia who are at the highest risk and require the most intensive management. There is an unmet need for additional treatment options beyond currently-available treatments for lowering of the LDL-C level to reduce cardiovascular risk.

In February 2013, we and MDCO (acquired by Novartis in January 2020) entered into a license and collaboration agreement pursuant to which we granted to MDCO an exclusive, worldwide license to develop, manufacture and commercialize RNAi therapeutics targeting PCSK9 for the treatment of hypercholesterolemia and other human diseases. Following its acquisition of MDCO, Novartis has all of the rights and obligations under the MDCO agreement. A description of the MDCO agreement is included below under the heading "Strategic Alliances and Collaborations."

Regulatory filings and approvals for Leqvio were based on positive results from the robust ORION clinical development program that included a comprehensive set of clinical trials to assess LDL-C lowering and safety in over 3,600 patients. This Phase 3 program represents the largest clinical program conducted to date for an investigational RNAi therapeutic program. Most recently, in November 2022, Novartis announced results from its Phase 2 open-label extension ORION-3 trial, which showed that Leqvio provides effective and sustained LDL-C reduction over a four-year period in patients with either ASCVD or ASCVD risk equivalent, and elevated LDL-C despite maximally tolerated statin therapy.

Multiple additional Phase 3 trials are currently ongoing, including cardiovascular outcomes trials, ORION-4 and the Novartis initiated VICTORION-2-PREVENT.

Additional Late-Stage Clinical Development Programs

Fitusiran — Hemophilia

Fitusiran is an investigational, subcutaneously administered RNAi therapeutic targeting antithrombin, or AT, for the treatment of people with hemophilia A and B, with and without inhibitors, in collaboration with our partner, Sanofi. Fitusiran is designed to lower levels of AT with the goal of promoting sufficient thrombin generation to prevent bleeding. AT acts by inactivating thrombin and other coagulation factors, and plays a key role in normal hemostasis by helping to limit the process of fibrin clot formation.

Hemophilia is a hereditary bleeding disorder characterized by an underlying defect in the ability to generate adequate levels of thrombin needed for effective fibrin clot formation, thereby resulting in recurrent bleeds into joints, muscles, and major internal organs. Lowering AT in the hemophilia setting may promote the generation of sufficient levels of thrombin needed to form an effective fibrin clot and prevent bleeding. This rationale is supported by human genetic data suggesting that co-inheritance of thrombophilic mutations, including AT deficiency, may ameliorate bleeding in hemophilia. We believe this approach is a unique and innovative strategy for preventing bleeding in people with hemophilia.

There are approximately 200,000 people living with hemophilia A and hemophilia B worldwide. Standard treatment for people with hemophilia currently involves replacement of the deficient clotting factor either as prophylaxis or on-demand

therapy, which can lead to a temporary restoration of thrombin generation capacity. However, with current factor replacement treatments people with hemophilia are at risk of developing neutralizing antibodies, or inhibitors, to their replacement factor, a very serious complication affecting as many as one third of people with severe hemophilia A and a smaller fraction of people with hemophilia B. People who develop inhibitors become refractory to replacement factor therapy and are twice as likely to be hospitalized for a bleeding episode.

Fitusiran is currently being evaluated in the ATLAS Phase 3 program. In October 2020, Sanofi announced that it voluntarily paused dosing in all ongoing fitusiran clinical studies to assess reports of non-fatal thrombotic events in patients participating in the ATLAS Phase 3 program. Following an assessment of available data and alignment with the FDA, in December 2020, Sanofi announced that it would resume fitusiran dosing in ongoing adolescent and adult clinical studies. Sanofi has since resumed fitusiran dosing in all ongoing studies with protocol amendments to address adjustments to dose and dosing regimen. To allow for the appropriate collection and assessment of safety and efficacy data under the amended protocols with additional lower doses, Sanofi expects that global regulatory submission timelines for the adult and adolescent studies will be delayed, subject to alignment with health authorities, and in October 2021, Sanofi announced that the potential filing date for fitusiran had been moved to 2024. Fitusiran has received both U.S. and EU Orphan Drug Designations for the treatment of hemophilia A and B.

Sanofi presented positive results from the ATLAS-A/B and ATLAS-INH Phase 3 studies of fitusiran in December 2021, and in July 2022, Sanofi presented positive results from the Phase 3 ATLAS-PPX study evaluating the efficacy and safety of once-monthly fitusiran (80 mg) in adults and adolescents with severe hemophilia A or B who were previously treated with prior factor or bypassing agent prophylaxis.

In January 2018, we and Sanofi entered into an amendment to our 2014 collaboration, as well as the ALN-AT3 Global License Terms, which as further amended in April 2019 are referred to as the A&R AT3 License Terms, pursuant to which Sanofi has global rights to develop and commercialize fitusiran and any back-up products. The 2014 Sanofi collaboration, as amended, as well as the A&R AT3 License Terms, are described below under the heading “Strategic Alliances and Collaborations.”

Cemdisiran — Complement-Mediated Diseases

Cemdisiran is a subcutaneously administered, investigational RNAi therapeutic targeting the C5 component of the complement pathway in development for the treatment of complement-mediated diseases. The complement system plays a central role in immunity as a protective mechanism for host defense, but its dysregulation results in a broad range of human diseases including immunoglobulin A nephropathy, or IgAN, myasthenia gravis, and paroxysmal nocturnal hemoglobinuria, amongst others.

We are currently advancing cemdisiran as a monotherapy for the treatment of IgAN, and in June 2022, we announced positive topline results from the Phase 2 study of cemdisiran in adult patients with IgAN. In November 2022, Regeneron exercised its right to opt-out of the collaboration agreement on the cemdisiran monotherapy program. We continue to perform our obligations under the collaboration agreement and are evaluating options for further development in this disease. Cemdisiran is also being evaluated by our partner, Regeneron, in combination with Regeneron’s pozelimab (REGN3918), an anti-C5 monoclonal antibody in Phase 3 studies in myasthenia gravis and paroxysmal nocturnal hemoglobinuria. Regeneron's decision to opt-out of the collaboration agreement on the monotherapy program has no impact on Regeneron’s ongoing efforts under a separate license agreement to develop the cemdisiran and pozelimab combination therapy.

Early-Stage Clinical Development Programs

Zilebesiran (formerly ALN-AGT) — Hypertension

Zilebesiran is an investigational, subcutaneously administered RNAi therapeutic targeting angiotensinogen, or AGT, in development for the treatment of hypertension in high unmet need populations. AGT is the most upstream precursor in the renin-angiotensin-aldosterone system, a cascade which has a demonstrated role in blood pressure regulation and its inhibition has well-established anti-hypertensive effects. Zilebesiran inhibits the synthesis of AGT in the liver, potentially leading to durable reductions in AGT protein and ultimately, in the vasoconstrictor angiotensin II.

Hypertension is a complex multifactorial disease clinically defined by most major guidelines as a systolic blood pressure of above 140 mm Hg and/or a diastolic blood pressure greater than 90 mm Hg, though the American College of Cardiology/American Heart Association guidelines define hypertension as a systolic blood pressure above 130 mm Hg and/or a diastolic blood pressure greater than 80 mm Hg. More than one billion people worldwide live with hypertension. In the U.S. alone, approximately 47 percent of adults live with hypertension, with more than half of patients on medication remaining above the blood pressure target level. Despite the availability of anti-hypertensive medications, there remains a significant unmet medical need, especially given the poor rates of adherence to existing daily oral medications and daily peak and trough effects, resulting in inconsistent blood pressure control and an increased risk for stroke, heart attack and premature death. In particular, there are a number of high unmet need settings where novel approaches to hypertension warrant additional development focus, including patients with poor medication adherence and in patients with high cardiovascular risk.

KARDIA-1 and KARDIA-2, Phase 2 clinical studies for zilebesiran were initiated in June and November 2021, respectively. KARDIA-1 is designed to evaluate zilebesiran as a monotherapy across different doses administered quarterly and biannually, whereas KARDIA-2 is evaluating the safety and efficacy of zilebesiran administered biannually as a concomitant therapy in patients whose blood pressure is not adequately controlled by a standard of care antihypertensive medication. In January 2023, we announced that we achieved full enrollment of patients in the KARDIA-1 Phase 2 study, with topline results anticipated in mid-2023. We are continuing to enroll patients in the KARDIA-2 study, and expect to complete enrollment in early 2023 and report topline results at or around year-end 2023.

ALN-HBV02 (VIR-2218) – Chronic Hepatitis B and D Virus Infection

ALN-HBV02 (VIR-2218) is a subcutaneously administered, investigational RNAi therapeutic targeting the HBV genome for the treatment of chronic HBV infection, which is being advanced by our collaborators at Vir. ALN-HBV02 is designed to inhibit expression of all HBV proteins, including hepatitis B surface antigen. Almost one-third of the world's population have previous or current HBV infection. Worldwide, more than 250 million people are chronically infected with HBV, and an estimated 1 million people die each year from complications of chronic HBV such as cirrhosis and hepatocellular carcinoma. Current treatment options include life-long suppressive antiviral therapies. There is a significant need for safe and convenient novel therapeutics that restore the host immune response, leading to control of the virus after a finite duration of therapy, which is the definition of a functional cure.

The safety and efficacy of ALN-HBV02 are currently being investigated in an ongoing Phase 2 trial, and in June 2022, Vir reported preliminary results that demonstrated that a six-dose regimen provided greater and more durable reductions in hepatitis B surface antigen than a two-dose regimen, with all participants achieving a >1 log10 IU/mL reduction during the trial. In addition, in 2022, Vir continued to progress a Phase 2 combination trial of ALN-HBV02 with pegylated interferon-alpha, as well as a triple combination with VIR-3434 and interferon, each to evaluate the potential for the combination to result in a functional cure of HBV. ALN-HBV02 is also being explored in a Phase 2 study evaluating ALN-HBV-02 and VIR-3434 as monotherapy and in combination for the treatment of people living with chronic hepatitis D virus, or HDV. Vir plans to report additional results from the Phase 2 studies in HBV in 2023, and data from the Phase 2 study in HDV is expected in the second half of 2023. ALN-HBV02 is also being investigated in additional clinical trials with collaborators of Vir.

ALN-HSD – Non-alcoholic Steatohepatitis

ALN-HSD is a subcutaneously administered, investigational RNAi therapeutic targeting HSD17B13 in development in collaboration with our partner, Regeneron, for the treatment of NASH. NASH is a highly prevalent chronic liver disease in which inflammation and liver cell injury are caused by accumulation of hepatic fat. NASH is a subset of a group of conditions called nonalcoholic fatty liver disease that can lead to progressive fibrosis, cirrhosis, and hepatocellular carcinoma. Comorbidities include obesity, metabolic syndrome, and type 2 diabetes. Approximately 16 million people in the U.S. live with NASH, with prevalence of the disease increasing due to rising rates of obesity. NASH is projected to be the leading indication for liver transplants in developed countries within the next 10 years. There are currently no approved medical therapies for NASH.

In September 2022, we, in collaboration with our partner, Regeneron, reported on positive results from a Phase 1 study of ALN-HSD in healthy volunteers and patients with NASH. In December 2022, we further elaborated on these results demonstrating robust target engagement and safety profile that supports continued clinical development. Regeneron will be leading continued development of the ALN-HSD program from Phase 2 onward.

ALN-APP – Alzheimer's Disease and Cerebral Amyloid Angiopathy

ALN-APP is an investigational, intrathecally administered RNAi therapeutic targeting amyloid precursor protein, or APP, in development in collaboration with Regeneron for the treatment of Alzheimer's disease, or AD, and cerebral amyloid angiopathy, or CAA. Genetic mutations that increase production of APP or alter its cleavage cause early-onset AD, early-onset CAA, or both. ALN-APP is designed to decrease APP mRNA in the CNS to decrease synthesis of APP protein and all downstream intracellular and extracellular APP-derived cleavage products, including amyloid beta (Aβ). Reducing APP protein production is expected to reduce the secretion of Aβ peptides that aggregate into extracellular amyloid deposits in AD and CAA and reduce the intraneuronal APP cleavage products that trigger the formation of neurofibrillary tangles and cause neuronal dysfunction in AD. ALN-APP is the first program utilizing our C16 conjugate technology, which enables enhanced delivery to cells in the CNS, to enter clinical development.

In early 2022, we initiated a Phase 1 study of ALN-APP in patients with early-onset AD, and in October 2022, we announced that enrollment and dose escalation continue in the Phase 1 study, and initial results are expected in early 2023.

Additional Early-Stage and Pre-clinical Programs

In addition to the programs listed above, we are also advancing other earlier-stage pipeline programs, including ALN-TTRsc04 for ATTR amyloidosis, ALN-KHK for Type 2 diabetes mellitus and ALN-PNP for NASH, and filed CTAs for each program during 2022. During 2023, we plan to file two to four investigational new drug applications, or INDs, or CTAs from our organic product engine. We also intend to continue to build on our progress with extrahepatic delivery during 2023,

advancing our eye and CNS programs under our collaboration with Regeneron, as well as continuing to advance other extrahepatic delivery initiatives.

Our Collaboration and Licensing Strategy

Our business strategy is to develop and commercialize a broad pipeline of RNAi therapeutic products directed towards transformative rare and prevalent diseases, including continued focus on our four STArs. As part of this strategy, we have entered into, and expect to enter into additional, collaboration and licensing agreements as a means of obtaining resources, capabilities and funding to advance our investigational RNAi therapeutic programs.

Our collaboration strategy is to form alliances that create significant value for ourselves and our collaborators in the advancement of RNAi therapeutics as a new class of innovative medicines. Specifically, with respect to our CNS/Ocular Disease pipeline, in April 2019, we entered into a global, strategic collaboration with Regeneron to discover, develop and commercialize RNAi therapeutics for a broad range of diseases by addressing disease targets expressed in the eye and CNS, in addition to a select number of targets expressed in the liver. In July 2020, Regeneron exercised its co-development/co-commercialization option on our first CNS-targeted development candidate, ALN-APP, an investigational RNAi therapeutic in development for the treatment of hereditary cerebral amyloid angiopathy and autosomal dominant Alzheimer's Disease, which we are leading. We are also advancing multiple other programs with Regeneron.

With respect to our Cardio-Metabolic pipeline, in March 2013, we entered into an exclusive, worldwide license with MDCO (acquired by Novartis in January 2020) pursuant to which MDCO was granted the right to develop, manufacture and commercialize RNAi therapeutics targeting PCSK9 for the treatment of hypercholesterolemia and other human diseases, including inclisiran. In March 2018, we entered into a discovery collaboration with Regeneron to identify RNAi therapeutics for NASH, and potentially other related diseases, and in November 2018, we and Regeneron entered into a separate, fifty-fifty collaboration to further research, co-develop and commercialize any therapeutic product candidates that emerge from these discovery efforts. In April 2020, we entered into a development and commercialization collaboration with Dicerna to advance investigational RNAi therapeutics for the treatment of alpha-1 liver disease.

With respect to our Hepatic Infectious Disease pipeline, in October 2017, we announced an exclusive licensing agreement with Vir for the development and commercialization of RNAi therapeutics for infectious diseases, including chronic HBV infection. In March 2020, we announced an expansion of our exclusive licensing agreement with Vir to include the development and commercialization of RNAi therapeutics targeting SARS-CoV-2, the virus that causes the disease COVID-19, which we further expanded in April 2020 to include up to three additional targets focused on host factors for SARS-CoV-2, including angiotensin converting enzyme-2, or ACE2, and transmembrane protease, serine 2, or TMPRSS2, and potentially a third mutually selected host factor target. In July 2021, we notified Vir that we elected to discontinue ALN-COV, in development for the treatment of COVID-19, and all other COVID-19 research and development activities, based on a portfolio prioritization in view of the availability of highly effective vaccines and alternative treatment options. Following such discontinuation of COVID-19 related activities, we have no further obligations to work on the COVID-related targets and Vir has no further rights to such targets under our exclusive licensing agreement.

With respect to our Genetic Medicine pipeline, we formed a broad strategic alliance with Sanofi in 2014. In January 2018, we and Sanofi amended our 2014 collaboration and entered into the Exclusive License Agreement, referred to as the Exclusive TTR License, under which we have the exclusive right to pursue the further global development and commercialization of all TTR products, including ONPATTRO, AMVUTTRA and any back-up products, and the ALN-AT3 Global License Terms, referred to as the AT3 License Terms, under which Sanofi has the exclusive right to pursue the further global development and commercialization of fitusiran and any back-up products. In April 2019, we and Sanofi agreed to further amend the 2014 Sanofi collaboration to conclude the research and option phase and to amend and restate the AT3 License Terms to modify certain of the business terms.

We intend to continue to evaluate and explore partnership opportunities through collaboration and licensing arrangements, and may enter into new collaborations to advance certain products or disease areas. For example, in January 2022, we announced that we and Novartis agreed to collaborate on the discovery and development of an siRNA-based targeted therapy to restore functional liver cells in patients with end-stage liver diseases.

We also have entered into license agreements to obtain rights to intellectual property in the field of RNAi. In addition, because delivery of RNAi therapeutics has historically been an important objective of our research activities, we have entered into various collaboration and licensing arrangements with other companies and academic institutions to gain access to delivery technologies, including various LNP delivery technologies, and we may enter into such agreements in the future to gain access to products or technologies. For example, in 2021, we entered into a license and collaboration agreement with PeptiDream to discover and develop peptide-siRNA conjugates leveraging PeptiDream's proprietary Peptide Discovery Platform System technology.

Strategic Alliances and Collaborations

We have formed, and intend to continue to form, strategic alliances and collaborations to gain access to the financial, technical, clinical and commercial resources necessary to develop and market RNAi therapeutics. We expect these alliances and

collaborations to provide us with financial support in the form of upfront cash payments, license fees, equity investments, research, development, and sales and marketing support and/or funding, milestone payments and/or royalties or profit sharing based on sales of RNAi therapeutics. Below is a brief description of our key strategic alliances, financial collaboration and license agreements.

Product Alliances

Regeneron. In April 2019, we entered into a global, strategic collaboration with Regeneron to discover, develop and commercialize RNAi therapeutics for a broad range of diseases by addressing therapeutic targets expressed in the eye and CNS, in addition to a select number of targets expressed in the liver, which we refer to as the Regeneron Collaboration. The Regeneron Collaboration is governed by a Master Agreement, referred to as the Regeneron Master Agreement, which became effective in May 2019.

In connection with the Regeneron Master Agreement, we and Regeneron entered into (i) a binding co-co collaboration term sheet covering the continued development of cemdisiran, our C5 siRNA currently in Phase 2 development for IgAN as a monotherapy and (ii) a binding license term sheet to evaluate anti-C5 antibody-siRNA combinations for C5 complement-mediated diseases including evaluating the combination of Regeneron's pozelimab (REGN3918), currently in Phase 3 development, and cemdisiran. The C5 co-co collaboration and license agreements were executed in August 2019.

Under the terms of the Regeneron Collaboration, we will work exclusively with Regeneron to discover RNAi therapeutics for eye and CNS diseases for an initial five-year research period, subject to extension for up to an additional five years, or the Initial Research Term. The Regeneron Collaboration also covers a select number of RNAi therapeutic programs designed to target genes expressed in the liver, including our previously-announced collaboration with Regeneron to identify RNAi therapeutics for the chronic liver disease NASH. We retain broad global rights to all of our other unpartnered liver-directed clinical and pre-clinical pipeline programs.

Regeneron will lead development and commercialization for all programs targeting eye diseases (subject to limited exceptions), entitling us to certain potential milestone and royalty payments pursuant to the terms of a license agreement, the form of which has been agreed upon by the parties. We and Regeneron will alternate leadership on CNS and liver programs, with the lead party retaining global development and commercial responsibility.

With respect to the programs directed to C5 complement-mediated diseases, we retain control of cemdisiran monotherapy development, and Regeneron is leading combination product development. Pursuant to the C5 co-co collaboration agreement, Regeneron notified us in November 2022 of its decision to exercise its right to opt-out of the further development and commercialization of cemdisiran monotherapy. As a result, Regeneron no longer shares costs and potential future profits on any monotherapy program with us and we are solely responsible for all development and commercialization costs and Regeneron will be eligible to receive tiered double-digit royalties on net sales. Under the C5 license agreement, for cemdisiran to be used as part of a combination product, Regeneron is solely responsible for all development and commercialization costs and we will receive low double-digit royalties and commercial milestones of up to $325.0 million on any potential combination product sales. The C5 license agreement is not impacted by Regeneron's opt-out under the C5 co-co collaboration agreement.

We and Regeneron plan to advance programs directed to up to 30 targets under the Regeneron Collaboration during the Initial Research Term. In July 2020, Regeneron exercised its co-development/co-commercialization option on our first CNS-targeted development candidate, ALN-APP, an investigational RNAi therapeutic in development for the treatment of hereditary cerebral amyloid angiopathy and autosomal dominant Alzheimer's Disease, which we are leading. We are also advancing multiple other programs with Regeneron.

For more information regarding the Regeneron Collaboration, including the ongoing or expected financial and accounting impact on our business, please read Note 4, Net Revenues from Collaborations, to our consolidated financial statements included in Part II, Item 8, "Financial Statements and Supplementary Data," of this Annual Report on Form 10-K.

Sanofi. In January 2014, we entered into a global, strategic collaboration with Sanofi to discover, develop and commercialize RNAi therapeutics as Genetic Medicines to treat orphan diseases, referred to as the 2014 Sanofi collaboration. The 2014 Sanofi collaboration superseded and replaced the previous collaboration between us and Sanofi entered into in October 2012 to develop and commercialize RNAi therapeutics targeting TTR for the treatment of hATTR amyloidosis, including patisiran and revusiran, in Japan and the Asia-Pacific region.

In January 2018, we and Sanofi entered into an amendment to our 2014 Sanofi collaboration. In connection and simultaneously with entering into the 2018 amendment to the 2014 Sanofi collaboration, we and Sanofi also entered into the Exclusive TTR License and the AT3 License Terms. As a result, we have the exclusive right to pursue the further global development and commercialization of all TTR products, including ONPATTRO, AMVUTTRA and any back-up products, and Sanofi has the exclusive right to pursue the further global development and commercialization of fitusiran and any back-up products. Under the 2018 amendment and the Exclusive TTR License, Sanofi is eligible to receive (i) royalties up to 25%, increasing over time, based on annual net sales of ONPATTRO in territories excluding the U.S., Canada and Western Europe, provided royalties on annual net sales of ONPATTRO in Japan were set at 25% beginning as of the effective date of the Exclusive TTR License, (ii) tiered royalties of 15% to 30% based on global annual net sales of AMVUTTRA (consistent with

the royalties due to us from Sanofi on fitusiran), and (iii) tiered royalties of up to 15% based on global annual net sales of any back-up products, in each case by us, our affiliates and our sublicensees. The collaboration amendment entered into in April 2019 described below made no changes to the terms described in clauses (i)-(iii) above, which remain in full force and effect.

In April 2019, we and Sanofi agreed to further amend the 2014 Sanofi collaboration to conclude the research and option phase and to amend and restate the AT3 License Terms pursuant to the A&R AT3 License Terms, to modify certain of the business terms. The material collaboration terms for fitusiran were unchanged. Under the A&R AT3 License Terms, we are eligible to receive tiered royalties of 15% to 30% based on global annual net sales of fitusiran and up to 15% based on global annual net sales of any back-up products controlled by Sanofi, in each case by Sanofi, its affiliates and its sublicensees. In connection with entering into the 2019 amendment and the A&R AT3 License Terms, we agreed to advance, at our cost, a selected investigational asset in an undisclosed rare genetic disease through the end of IND-enabling studies. Following completion of such studies, we will transition, at our cost, such asset to Sanofi. Thereafter, Sanofi will fund all potential future development and commercialization costs for such asset. If this asset is approved, we will be eligible to receive tiered double-digit royalties on global net sales.

Novartis AG. In February 2013, we and MDCO entered into a license and collaboration agreement pursuant to which we granted to MDCO an exclusive, worldwide license to develop, manufacture and commercialize RNAi therapeutics targeting PCSK9 for the treatment of hypercholesterolemia and other human diseases. Under the MDCO agreement, we had responsibility for the development of inclisiran until Phase 1 Completion, as defined in the MDCO agreement, at our cost. In late 2015, MDCO assumed responsibility for all development and commercialization of inclisiran, at its sole cost. In January 2020, MDCO was acquired by Novartis and in December 2020, the EC granted marketing authorization for Leqvio (inclisiran) for the treatment of adults with hypercholesterolemia or mixed dyslipidemia, following a positive CHMP opinion. In December 2021, Leqvio was approved by the FDA for the treatment of adults with HeFH or clinical ASCVD as an adjunct to diet and maximally tolerated dose of statin. For more information regarding the MDCO agreement, including its ongoing financial and accounting impact on our business, please read Note 4, Net Revenues from Collaborations, to our consolidated financial statements included in Part II, Item 8, “Financial Statements and Supplementary Data,” of this Annual Report on Form 10-K.

Vir Biotechnology, Inc. In October 2017, we and Vir entered into a collaboration and license agreement, or the Vir Agreement, pursuant to which we granted to Vir an exclusive license to develop, manufacture and commercialize ALN-HBV02 (VIR-2218), for all uses and purposes other than certain excluded fields, as set forth in the agreement. In addition, we granted Vir an exclusive option for up to four additional RNAi therapeutics programs for the treatment of infectious diseases. In March and April 2020, we entered into amendments to the Vir Agreement to expand our collaboration to include the development and commercialization of RNAi therapeutics targeting SARS-CoV-2, the virus that causes the disease COVID-19, along with three additional targets focused on human host factors for SARS-CoV-2, including ACE2 and TMPRSS2 and potentially a third mutually selected host factor target. We further amended the Vir Agreement in December 2020, such that we were solely responsible for conducting pre-clinical research activities under the pre-clinical development plan at our discretion and sole expense and effective as of July 1, 2020, we were responsible for all pre-clinical development costs incurred under such plan. In July 2021, we notified Vir that we elected to discontinue ALN-COV, in development for the treatment of COVID-19, and all other COVID-19 research and development activities, based on a portfolio prioritization in view of the availability of highly effective vaccines and alternative treatment options. Following such discontinuation of COVID-19 related activities, we have no further obligations to work on the COVID-related targets and Vir has no further rights to such targets under our exclusive licensing agreement. For more information regarding the Vir Agreement, including its ongoing financial and accounting impact on our business, please read Note 4, Net Revenues from Collaborations, to our consolidated financial statements included in Part II, Item 8, “Financial Statements and Supplementary Data,” of this Annual Report on Form 10-K.

Strategic Financing Collaboration

The Blackstone Group Inc. In April 2020, we entered into a strategic financing collaboration with certain affiliates of Blackstone to accelerate our advancement of RNAi therapeutics. In connection with the collaboration, Blackstone agreed to provide us up to $2.0 billion in financing, including $1.0 billion in committed payments to acquire 50% of royalties and 75% of commercial milestones payable to us in connection with sales of Leqvio, up to $750.0 million in a first lien senior secured term loan, and up to $150.0 million towards the development of vutrisiran and zilebesiran (formerly ALN-AGT) pursuant to the funding agreement finalized in August 2020. In November 2021, Blackstone elected to opt-in to Phase 2 clinical trial funding of zilebesiran, committing to fund, upon meeting certain patient enrollment thresholds, up to $26.0 million. As part of the strategic financing collaboration, Blackstone also purchased an aggregate of $100.0 million of our common stock. Please read Note 5 and Note 11 to our consolidated financial statements included in Part II, Item 8, “Financial Statements and Supplementary Data,” of this Annual Report on Form 10-K for additional details on our transaction with Blackstone, including its ongoing financial and accounting impact on our business.

Other Strategic License Agreements

Dicerna Pharmaceuticals, Inc. In April 2020, we and Dicerna (acquired by Novo Nordisk in December 2021) formed a development and commercialization collaboration on investigational RNAi therapeutics for the treatment of alpha-1 liver disease. Under the development and commercialization agreement entered into between the parties, our ALN-AAT02 and

Dicerna's belcesiran (formerly DCR-A1AT), investigational RNAi therapeutics, each in Phase 1/2 development, will be explored for the treatment of alpha-1 liver disease. In addition, in April 2020, we and Dicerna entered into a Patent Cross-License Agreement, pursuant to which each party agreed to cross-license its respective intellectual property related to our lumasiran program and Dicerna's nedosiran program, each for the treatment of PH.

PeptiDream, Inc. In July 2021, we entered into a license and collaboration agreement with PeptiDream to discover and develop peptide-siRNA conjugates to create multiple opportunities to deliver RNAi therapeutics to tissues outside the liver. Through this collaboration, the companies will collaborate to select and optimize peptides for targeted delivery of small siRNA molecules to a wide range of cell types and tissues via specific interactions with receptors expressed on the target cells. Under the terms of the alliance, we will select a set of receptors for PeptiDream's peptide discovery platform. PeptiDream will select, optimize, and synthesize peptides for each receptor. We will then generate peptide-siRNA conjugates and perform in vitro and in vivo studies to support final peptide selection. For more information regarding the collaboration agreement with PeptiDream, including its ongoing financial and accounting impact on our business, please read Note 4, Net Revenues from Collaborations, to our consolidated financial statements included in Part II, Item 8, "Financial Statements and Supplementary Data," of this Annual Report on Form 10-K.

Novartis AG. In January 2022, we announced that we and Novartis, entered into a collaboration and license agreement, referred to as the Novartis License Agreement, pursuant to which we granted to Novartis an exclusive, worldwide license to develop, manufacture and commercialize siRNAs targeting end-stage liver disease, potentially leading to the development of a treatment designed to promote the regrowth of functional liver cells and to provide an alternative to transplantation for patients with liver failure. Under the terms of the collaboration, we will develop and test potential siRNAs using target-specific assays developed by Novartis. Upon identification of a lead candidate, further development and clinical research will be conducted by Novartis. Pursuant to the Novartis License Agreement, we received an upfront fee, and may also receive milestone payments upon the achievement of certain development, regulatory and commercial milestones, as well as tiered royalties on the net sales of licensed products ranging from high-single-digit to sub-teen double-digit percentages. For more information regarding the Novartis License Agreement, including its ongoing financial and accounting impact on our business, please read Note 4, Net Revenues from Collaborations, to our consolidated financial statements included in Part II, Item 8, "Financial Statements and Supplementary Data," of this Annual Report on Form 10-K.

Ionis Pharmaceuticals, Inc. In January 2015, we and Ionis Pharmaceuticals, Inc., or Ionis, entered into a second amended and restated strategic collaboration and license agreement, which we further amended in July 2015, or the 2015 Ionis agreement. The 2015 Ionis agreement provides for certain new exclusive target cross-licenses of intellectual property on eight disease targets, providing each company with exclusive RNA therapeutic license rights for four programs, and extended the parties' existing non-exclusive technology cross-license, which was originally entered into in 2004 and was amended and restated in 2009, through April 2019. Pursuant to the 2015 Ionis agreement, Ionis granted to us an exclusive, low single-digit royalty-bearing license to its chemistry, motif, mechanism and target-specific intellectual property for oligonucleotide therapeutics against four targets. In exchange, we granted to Ionis an exclusive, low single-digit royalty-bearing license to our chemistry, motif, mechanism and target-specific intellectual property for oligonucleotide therapeutics against four targets. Under the original agreement, Ionis licensed to us its patent estate related to antisense motifs and mechanisms and oligonucleotide chemistry for double-stranded RNAi products in exchange for a previously disclosed technology access fee, participation in fees for our partnering programs and future milestone and royalty payments from us for programs that incorporate Ionis' intellectual property. We have the right to use Ionis' intellectual property in our development programs or in collaborations and Ionis agreed not to grant licenses under these patents to any other organization for the discovery, development and commercialization of double-stranded RNA products designed to work through an RNAi mechanism, except in the context of a collaboration in which Ionis plays an active role. In turn, in exchange for option fees, and future milestone and royalty payments from Ionis for RNAi programs that incorporate certain of our intellectual property, we non-exclusively licensed to Ionis our patent estate relating to antisense motifs and mechanisms and oligonucleotide chemistry to research, develop and commercialize single-stranded antisense therapeutics, single stranded RNAi therapeutics and to research double-stranded RNAi compounds. Ionis also received a license to develop and commercialize double-stranded RNAi drugs targeting a limited number of therapeutic targets on a non-exclusive basis.

Intellectual Property, Proprietary Rights and Exclusivities

We have devoted considerable effort and resources through both in-licensing and filing patent applications on our own inventions, as well as protecting our trade secrets and know-how to establish what we believe to be a strong intellectual property position relevant to RNAi therapeutic products and delivery technologies. In this regard, we have amassed a portfolio of patents, patent applications and other intellectual property covering:

- fundamental aspects of the structure and uses of siRNAs, including their use as therapeutics, and RNAi-related mechanisms;
- chemical modifications to siRNAs that improve their suitability for therapeutic and other uses;
- compositions of siRNAs directed to specific targets as well as their methods of use, including as therapeutics and diagnostics;

- delivery technologies, such as in the fields of siRNA conjugates, including carbohydrate, lipophilic and other conjugates as well as cationic liposomes and other delivery vehicles; and
- all aspects of our development candidates and marketed products, with an additional level of protection for trademarks related to our marketed products.

In addition to patents and trademarks for our marketed products, we seek to obtain all available regulatory exclusivities for our marketed products, including data and orphan exclusivities in the relevant jurisdictions.

Key Patents and Regulatory Exclusivities

We typically obtain protection of our product candidates with patents and patent applications directed to compositions of matter and their uses. Below is a summary of selected granted patents that we own or control covering products marketed by us in the U.S. and Europe.

ONPATTRO

Patent Number	Country/Region*	Patent Type	Expiration Date**	Owner/Licensor
8168775	United States	Compositions of Matter & Methods of Use	8/10/2032	Alnylam
8334373	United States	Compositions of Matter & Methods of Use	5/27/2025	Alnylam
8741866	United States	Compositions of Matter & Methods of Use	10/20/2029	Alnylam
9234196	United States	Compositions of Matter & Methods of Use	10/20/2029	Alnylam
8802644	United States	Compositions of Matter & Methods of Use	10/21/2030	Arbutus Biopharma
8158601	United States	Compositions of Matter & Methods of Use	11/10/2030	Arbutus Biopharma
9943538	United States	Compositions of Matter	11/4/2023	Ionis Pharmaceuticals
9943539	United States	Compositions of Matter	11/4/2023	Ionis Pharmaceuticals
2937418	Europe	Compositions of Matter & Methods of Use	8/28/2033	Alnylam
2344639	Europe	Compositions of Matter & Methods of Use	10/20/2029	Alnylam
2440183	Europe	Compositions of Matter	10/21/2030	Arbutus Biopharma

* Shown here are selected granted patents in the U.S. and Europe. Additional granted and pending patents in the U.S., Europe and other countries may be available.

** Expiration dates listed here include any granted or anticipated patent term extensions and supplemental protection certificates but exclude any pediatric extensions that may be available.

In addition, in connection with our FDA approval on August 10, 2018, the FDA granted ONPATTRO new chemical entity, or NCE, exclusivity until August 10, 2023, and Orphan Drug Exclusivity, or ODE, until August 10, 2025. In connection with our EMA approval on August 26, 2018, the EMA granted ONPATTRO Marketing Exclusivity and ODE until August 26, 2028.

AMVUTTRA

Patent Number	Country/Region*	Patent Type	Expiration Date**	Owner/Licensor
8106022	United States	Compositions of Matter & Methods of Use	12/12/2029	Alnylam
8828956	United States	Compositions of Matter & Methods of Use	12/4/2028	Alnylam
9370581	United States	Compositions of Matter & Methods of Use	12/4/2028	Alnylam
9399775	United States	Compositions of Matter & Methods of Use	11/16/2032	Alnylam
10131907	United States	Compositions of Matter & Methods of Use	8/24/2028	Alnylam
10208307	United States	Compositions of Matter & Methods of Use	7/28/2036	Alnylam
10570391	United States	Compositions of Matter	11/16/2032	Alnylam
10612024	United States	Compositions of Matter & Methods of Use	8/14/2035	Alnylam
10683501	United States	Methods of Use	7/28/2036	Alnylam
10806791	United States	Compositions of Matter	12/4/2028	Alnylam
11286486	United States	Methods of Use	7/28/2036	Alnylam
11401517	United States	Compositions of Matter & Methods of Use	8/14/2035	Alnylam
3301177	Europe	Compositions of Matter & Methods of Use	11/16/2032	Alnylam
3329002	Europe	Compositions of Matter & Methods of Use	7/28/2036	Alnylam

* Shown here are selected granted patents in the U.S. and Europe. Additional granted and pending patents in the U.S., Europe and other countries may be available.
** Expiration dates listed here do not account for any patent term extensions, supplemental protection certificates or pediatric extensions that may be available.

In addition, in connection with our FDA approval on June 13, 2022, the FDA granted AMVUTTRA NCE exclusivity until June 13, 2027. In connection with our EMA approval on September 15, 2022, the EMA granted AMVUTTRA Marketing Exclusivity and ODE until September 15, 2032.

GIVLAARI

Patent Number	Country/Region*	Patent Type	Expiration Date**	Owner/Licensor
8106022	United States	Compositions of Matter & Methods of Use	12/12/2029	Alnylam
8828956	United States	Compositions of Matter & Methods of Use	12/4/2028	Alnylam
9133461	United States	Compositions of Matter & Methods of Use	5/14/2033	Alnylam/Icahn School of Medicine at Mount Sinai
9150605	United States	Compositions of Matter	8/28/2025	Ionis Pharmaceuticals
9631193	United States	Methods of Use	3/15/2033	Alnylam/Icahn School of Medicine at Mount Sinai
9708610	United States	Compositions of Matter & Methods of Use	1/1/2024	Ionis Pharmaceuticals
9708615	United States	Compositions of Matter & Methods of Use	3/8/2024	Alnylam
10119143	United States	Compositions of Matter & Methods of Use	10/3/2034	Alnylam/Icahn School of Medicine at Mount Sinai
10125364	United States	Compositions of Matter & Methods of Use	3/15/2033	Alnylam/Icahn School of Medicine at Mount Sinai
10131907	United States	Compositions of Matter & Methods of Use	8/24/2028	Alnylam
10273477	United States	Compositions of Matter	3/8/2024	Alnylam
2836595	Europe	Compositions of Matter & Methods of Use	4/10/2033	Alnylam/Icahn School of Medicine at Mount Sinai
2336317	Europe	Compositions of Matter	6/14/2024	Alnylam
2957568	Europe	Compositions of Matter	11/4/2023	Ionis Pharmaceuticals
1560840	Europe	Compositions of Matter	11/4/2023	Ionis Pharmaceuticals

* Shown here are selected granted patents in the U.S. and Europe. Additional granted and pending patents in the U.S., Europe and other countries may be available.
** Expiration dates listed here do not account for any patent term extensions, supplemental protection certificates or pediatric extensions that may be available.

In addition, in connection with our FDA approval on November 20, 2019, the FDA granted GIVLAARI NCE exclusivity until November 20, 2024, and ODE until November 20, 2026. In connection with our EMA approval on March 2, 2020, the EMA granted GIVLAARI Marketing Exclusivity and ODE until March 2, 2030.

OXLUMO

Patent Number	Country/Region*	Patent Type	Expiration Date**	Owner/Licensor
8106022	United States	Compositions of Matter & Methods of Use	12/12/2029	Alnylam
8828956	United States	Compositions of Matter & Methods of Use	12/4/2028	Alnylam
9828606	United States	Compositions of Matter	12/26/2034	Dicerna Pharmaceuticals
10131907	United States	Compositions of Matter & Methods of Use	8/24/2028	Alnylam
10435692	United States	Methods of Use	12/26/2034	Dicerna Pharmaceuticals
10465195	United States	Compositions of Matter & Methods of Use	12/26/2034	Dicerna Pharmaceuticals
10478500	United States	Compositions of Matter & Methods of Use	10/9/2035	Alnylam
10487330	United States	Compositions of Matter & Methods of Use	12/26/2034	Dicerna Pharmaceuticals
10612024	United States	Compositions of Matter	8/14/2035	Alnylam
10612027	United States	Compositions of Matter & Methods of Use	8/14/2035	Alnylam
3087184	Europe	Compositions of Matter	12/26/2034	Dicerna Pharmaceuticals

* Shown here are selected granted patents in the U.S. and Europe. Additional granted and pending patents in the U.S., Europe and other countries may be available.
** Expiration dates listed here do not account for any patent term extensions, supplemental protection certificates or pediatric extensions that may be available.

In addition, in connection with our FDA approval on November 23, 2020, the FDA granted OXLUMO NCE exclusivity until November 23, 2025 and ODE until November 23, 2027. In connection with our EMA approval on November 19, 2020, the EMA granted OXLUMO Marketing Exclusivity and ODE until November 19, 2030.

Trademarks

We file trademarks to protect our corporate brand and our products. Typically we file trademark applications in the U.S., Europe and elsewhere in the world as appropriate. In addition to multiple pending trademark applications in the U.S. and other major countries, we have registered trademarks in the U.S., including but not limited to Alnylam® and the Alnylam logo, as well as ONPATTRO® and the ONPATTRO logo, AMVUTTRA® and the AMVUTTRA logo, GIVLAARI® and the GIVLAARI logo and OXLUMO® and the OXLUMO logo.

Competition

The pharmaceutical marketplace is extremely competitive, with hundreds of companies competing to discover, develop and market new drugs. We face a broad spectrum of current and potential competitors, ranging from very large, global pharmaceutical companies with significant resources, to other biotechnology companies with resources and expertise comparable to our own, to smaller biotechnology companies with fewer resources and expertise than we have. We believe that for most or all of our drug development programs, there will be one or more competing programs under development at other companies. In some cases, the companies with competing programs will have access to greater resources and expertise than we do and may be more advanced in those programs.

Competition for Our Business in General

The competition we face can be grouped into three broad categories:

- other companies working to develop RNAi and microRNA therapeutic products;
- companies developing technology known as antisense, which, like RNAi, attempts to silence the activity of specific genes by targeting the mRNAs copied from them; and
- marketed products and development programs for therapeutics that treat the same diseases for which we may also be developing treatments.

We are aware of several other companies that are working to develop RNAi therapeutic products. Some of these companies are seeking, as we are, to develop chemically synthesized siRNAs as drugs. Others are following a gene therapy approach, with

the goal of treating patients not with synthetic siRNAs but with synthetic, exogenously-introduced genes designed to produce siRNA-like molecules within cells.

Companies working on chemically synthesized siRNAs include Arrowhead Pharmaceuticals, Inc., or Arrowhead, and its collaborators Takeda Pharmaceutical Company Ltd., or Takeda, Janssen Pharmaceutics, Inc. or Janssen, Horizon Therapeutics PLC, or Horizon, GlaxoSmithKline PLC, or GSK, and Amgen Inc., or Amgen, Quark Pharmaceuticals, Inc., or Quark, F. Hoffmann-La Roche Ltd, or Roche, Silence Therapeutics plc, or Silence, and its collaborators, AstraZeneca plc, or AstraZeneca, Jiangsu Hansoh Pharmaceuticals Group Co., and Mallinckrodt plc, Arbutus Biopharma Corp., or Arbutus, Sylentis, S.A.U., or Sylentis, Novo Nordisk and its collaborators, Boehringer Ingelheim, AstraZeneca plc, or AstraZeneca, and Eli Lilly and Company, or Eli Lilly, WAVE Life Sciences Ltd., or WAVE, Silenseed Ltd., Ascletis Pharma Inc., Biomics Biopharma, Avidity Biosciences Inc., Dyne Therapeutics Inc., or Dyne, Atalanta Therapeutics Inc., Sirnaomics Inc., OliX Pharmaceuticals Inc., Ochre Bio, DTx Pharma, Inc., Sixfold Bioscience Inc., ProQR Therapeutics NV, or ProQR, Phio Pharmaceuticals, BioPath Holding Inc., Arcturus Therapeutics, Inc., or Arcturus, and Ascletis Pharma Inc. Several of these companies have licensed our intellectual property. Benitec Biopharma Ltd., or Benitec, is working on gene therapy approaches to RNAi therapeutics. Companies working on microRNA therapeutics include Regulus Therapeutics, Inc., Rosetta Genomics Ltd., MiNA Therapeutics, Inc, InteRNA Technologies B.V. and TransCode Therapeutics, Inc.

Antisense technology uses short, single-stranded, DNA-like molecules to block mRNAs encoding specific proteins. We believe that RNAi drugs may potentially have significant advantages over antisense oligonucleotide, or ASO, drugs, including greater potency and specificity. In addition to Ionis and its collaborators, including Biogen Inc., AstraZeneca, Novartis and Bayer AG, and several other companies have ASO-based product candidates in various stages of pre-clinical and clinical development, including Roche, Akcea Therapeutics, Inc. (acquired by Ionis in October 2020), or Akcea, Antisense Therapeutics, Ltd., Dyne, WAVE, GSK, Sarepta Therapeutics, Inc., ProQR and Eli Lilly.

The competitive landscape continues to expand, and we expect that additional companies will initiate programs focused on the development of RNAi therapeutic products using the approaches described above as well as potentially new approaches that may result in the more rapid development of RNAi therapeutics or more effective technologies for RNAi drug development or delivery.

Competing Drugs for Our Marketed Products and Late-Stage Investigational RNAi Therapeutics

ATTR Amyloidosis. Until a few years ago, liver transplantation was the only treatment option for patients with hATTR amyloidosis in the U.S. and in other countries. Only a subset of patients with early-stage disease qualify for this costly and invasive procedure, which carries significant morbidity and risk of mortality. Even following liver transplantation, the disease continues to progress for many patients, presumably due to ongoing deposition of wild-type TTR protein.

In addition to ONPATTRO and AMVUTTRA, approved treatments for hATTR amyloidosis now include inotersen (TEGSEDI, approved in many countries) and tafamidis (VYNDAQEL/VYNDAMAX, approved in many countries). Treatment indications vary by country/region for each product. We believe that the following approved drugs could compete with ONPATTRO and AMVUTTRA for the treatment of the polyneuropathy of hATTR amyloidosis in adults and for the treatment of ATTR amyloidosis with cardiomyopathy if patisiran is approved for that indication and/or if HELIOS-B is positive and vutrisiran is approved for that indication:

Drug	Company	Drug Description	Phase	Administration/Dosing
VYNDAQEL (tafamidis meglumine)	Pfizer Inc.	Small molecule drug to stabilize TTR protein	Approved in the EU, Japan and certain countries in Latin America for hATTR polyneuropathy (indication varies by region)	Daily oral capsule
VYNDAQEL/VYNDAMAX (tafamidis meglumine / tafamidis)	Pfizer Inc.	Small molecule drug to stabilize TTR protein	Approved to treat ATTR cardiomyopathy in the U.S., EU and Japan; (indication varies by region)	Daily oral capsule
TEGSEDI (inotersen)	Ionis	Anti-sense oligonucleotide, or ASO, to reduce production of TTR Protein	Approved in U.S., EU, Canada and Brazil for hATTR polyneuropathy (indication varies by region)	Weekly subcutaneous injection (SC)

Several investigational drugs also exist, in varying stages of clinical development, for ATTR amyloidosis. We believe that the following drug candidates, if approved, could compete with ONPATTRO and AMVUTTRA, for the treatment of the

polyneuropathy of hATTR amyloidosis in adults and for the treatment of ATTR amyloidosis with cardiomyopathy if patisiran is approved for that indication and/or if HELIOS-B is positive and vutrisiran is approved for that indication:

Drug	Company	Drug Description	Phase	Administration/Dosing
Eplontersen (IONIS-TTR-L_{Rx})	Ionis & AstraZeneca	ASO to reduce production of TTR Protein	Filed for approval in December 2022 for hATTR polyneuropathy	Monthly subcutaneous injection (SC)
Acoramidis (AG10)	BridgeBio Pharma, Inc. & AstraZeneca in Japan	Small molecule drug to stabilize TTR protein	Phase 3	Twice daily oral dose
NNC-6019 (PRX004)	Novo Nordisk	mAb to clear TTR amyloid deposits	Phase 2	Intravenous (IV) infusion every four weeks
NI006	AstraZeneca & Neurimmune AG	mAB to clear TTR amyloid deposits	Phase 1	Intravenous (IV) infusion
NTLA-2001	Intellia Therapeutics, Inc. & Regeneron	CRISPR/Cas9 gene therapy for TTR	Phase 1	One-time intravenous (IV) infusion

We are also aware of other companies that have pre-clinical development programs for the potential treatment of ATTR amyloidosis.

Acute Hepatic Porphyria. In addition to GIVLAARI, which is approved in the U.S. for the treatment of adults with AHP, and in the EU for the treatment of AHP in adults and adolescents aged 12 years and older, there are also two approved hemin products, Panhematin (U.S.) and Normosang (EU), for the treatment of acute porphyria attacks. Panhematin and Normosang are both administered by intravenous infusion and are blood products currently manufactured by Recordati S.p.A. There are currently no competing products approved for prophylactic use; however, there is off-label prophylactic use of hemin by some physicians. We are aware of other companies that have pre-clinical development programs for the potential treatment of AHP.

Primary Hyperoxaluria. In addition to OXLUMO, which was approved in the U.S. for the treatment of primary hyperoxaluria, or PH, type 1, and in the EU for the treatment of PH type 1 in patients of all ages, currently used treatments for PH include hyper hydration, oral citrate or dual liver/kidney transplantation. Transplantation is costly and is an invasive procedure, which carries significant morbidity and mortality. This leaves a high unmet medical need for a severe and primarily pediatric disorder. Presently, there are several investigational drugs in varying stages of clinical development for the treatment of PH. We believe that the following drug candidates, if approved, could compete with OXLUMO:

Drug	Company	Drug Description	Phase	Administration/Dosing
Nedosiran	Novo Nordisk	siRNA to reduce production of LDHA enzyme	Filed with FDA in September 2022	SC with monthly dosing
BBP-711	BridgeBio Pharma, Inc.	GO inhibitor	Phase 2/3	Oral
CHK-336	Chinook Therapeutics, Inc.	LDHA inhibitor	Phase 2	Oral
BMN-255	BioMarin Pharmaceutical, Inc.	Undisclosed	Phase 1/2	Oral

We are aware of other companies that have pre-clinical development programs for the potential treatment of PH.

Hypercholesterolemia. In addition to Leqvio, which was approved in the EU for the treatment of adults with hypercholesterolemia or mixed dyslipidemia and in the U.S. for the treatment of adults with HeFH or clinical ASCVD as an adjunct to diet and maximally tolerated dose of statin, the current standard of care for patients with hypercholesterolemia includes the use of dietary changes, lifestyle modification and the use of pharmacologic therapy. Front line therapy consists of HMG-CoA reductase inhibitors, commonly known as statins, which block production of cholesterol by the liver and increase clearance of LDL-C from the bloodstream. Several anti-PCSK9 antibodies have also been approved for the treatment of hypercholesterolemia in the U.S. and Europe. Other PCSK9-targeted approaches and other cholesterol lowering agents are in development at a number of companies.

We believe that the following approved drugs and, if approved, drug candidates, could compete with Leqvio:

Drug	Company	Drug Description	Phase	Administration/Dosing
Repatha	Amgen	Anti-PSCK9 mAb	Approved	SC
Praluent	Sanofi	Anti-PSCK9 mAb	Approved	SC
Vascepa	Amarin Corporation	Omega-3 lipid proven to reduce LDL-C and CV Risk	Approved	Oral
NEXLETOL (Bempedoic Acid)	Esperion Therapeutics, Inc.	Oral fatty acid and cholesterol synthesis dual inhibitor	Approved	Oral
Evkeeza (evinacumab)	Regeneron	Anti-ANGPTL3 mAb for hypercholesterolemia	Approved in HoFH	SC
Lerodalcibep (LIB-003)	LIB Therapeutics	Recombinant protein therapeutic	Phase 3	SC
MK-0616	Merck	Small molecule PCSK9 inhibitor	Phase 2	Oral
ARO-ANG3	Arrowhead	siRNA targeting ANGPTL3	Phase 2	SC
VERVE-101	Verve Therapeutics	CRISPR/CAS9 targeting PCSK9	Phase 1	One-time IV infusion

Hemophilia. The global market for treatments of hemophilia and bleeding disorders is valued at more than $10.0 billion. Products on the market include: Factor VIII replacement products; Factor IX replacement products; factor replacement products with extended half-lives, and most recently a bispecific antibody mimicking Factor VIII. For the treatment of persons with inhibitors, there is an approved Factor VIIa replacement product and an activated prothrombin complex concentrate, as well as a bispecific antibody mimicking Factor VIII. In addition, new, innovative molecules are currently in development which may offer new treatments for people with hemophilia A and B, with and without inhibitors. A number of companies are also actively developing gene therapy products that use virus-like particles to deliver a functional section of a particular gene into the liver cells of a person with hemophilia.

We believe that the following approved drugs and, if approved, drug candidates, could compete with fitusiran, if fitusiran receives regulatory approval, along with additional approved drugs and drug candidates not listed below:

Drug (Company)	Drug Description	Phase	Administration
Hemophilia A			
Advate (Takeda), Adynovate (Takeda), Kogenate (Bayer), Kovaltry (Bayer), Novoeight (Novo Nordisk), Xyntha (Pfizer), Nuwiq (Octapharma), Eloctate (Sanofi)	Recombinant FVIII factor products	Approved	IV
Valoctocogene roxaparvovec (BioMarin)	Gene therapy	Approved in EU; PDUFA Mar. 2023	IV - Single Administration
HEMLIBRA (Roche)	Bispecific antibody mimetic of FVIII	Approved	SC - Monthly
giroctocogene fitelparvovec (Pfizer & Sangamo Therapeutics)	Recombinant AAV2/6 Human Factor VIII Gene Therapy	Phase 3	IV – Single Administration
RG6357 (Roche & Spark Therapeutics)	Gene therapy	Phase 2	IV – Single Administration
Hemophilia B			
Rixubis (Takeda), Rebinyn (Novo Nordisk), BeneFIX (Pfizer), Alprolix (Sanofi), Idelvion (CSL Behring)	Recombinant FIX factor products	Approved	IV
Etranacogene dezaparvovec (uniQure/CSL Behring)	rAAV5 FIX gene therapy	Approved	IV - Single Administration
Fidanacogene elaparvovec (Spark Therapeutics)	Spark200 AAV FIX gene therapy	Phase 3	IV - Single Administration
Inhibitor Patients			
Emicizumab HEMLIBRA, ACE-910 (Roche)	Bispecific antibody mimetic of FVIII	Approved	SC - Monthly
Feiba (Takeda)	Bypassing agent	Approved	IV
NovoSeven (Novo Nordisk)	Bypassing agent	Approved	IV
Marstacimab (Pfizer)	Anti-TFPI antibody	Phase 3	SC - Weekly
Hemophilia A and B			
Concizumab, anti-TFPI (Novo Nordisk)	Anti-TFPI antibody	Phase 3	SC
Marstacimab (Pfizer)	Anti-TFPI antibody	Phase 3	SC - Weekly

Other Competition

Finally, for many of the diseases that are the subject of our early-stage clinical, pre-clinical development and discovery RNAi therapeutic programs, there are already drugs on the market or in development. However, notwithstanding the availability of existing drugs or drug candidates, we believe there currently exists sufficient unmet medical need to warrant the advancement of our investigational RNAi therapeutic programs.

Regulatory Matters

U.S. Regulatory Considerations

The research, testing, manufacture and marketing of drug products and their delivery systems are extensively regulated in the U.S. and the rest of the world. In the U.S., drugs are subject to rigorous regulation by the FDA. The Federal Food, Drug, and Cosmetic Act, or FDCA, and other federal and state statutes and regulations govern, among other things, the research, development, testing, approval, manufacture, storage, record keeping, reporting, labeling, marketing and distribution of drug products. Failure to comply with the applicable regulatory requirements may subject a company to a variety of administrative or judicially-imposed sanctions and the inability to obtain or maintain required approvals to test or market drug products. These sanctions could include, among other things, warning letters, product recalls, product seizures, total or partial suspension of production or distribution, clinical holds, injunctions, fines, civil penalties or criminal prosecution.

The steps ordinarily required before a new drug product may be marketed in the U.S. include nonclinical laboratory tests, animal tests and formulation studies, the submission to the FDA of an IND, which must become effective prior to commencement of clinical testing in the U.S., approval by an institutional review board, or IRB, at each clinical site before each trial may be initiated, completion of adequate and well-controlled clinical trials to establish that the drug product is safe and effective for the indication and other conditions of use for which FDA approval is sought, submission to the FDA of an NDA (or supplemental NDA for approved products), acceptance of the NDA for review by the FDA, and FDA review and approval of the NDA. Satisfaction of the FDA's pre-market approval requirements typically takes several years, but may vary

substantially depending upon the complexity of the product and the nature of the disease. Government regulation may delay, limit or prevent marketing of potential products for a considerable period of time and impose costly procedures on a company's activities. Success in early-stage clinical trials does not necessarily assure success in later-stage clinical trials. Data obtained from clinical activities, including but not limited to the data derived from our clinical trials for drug candidates, are not always conclusive and may be subject to alternative interpretations that could delay, limit or even prevent regulatory approval. Even if a product receives regulatory approval, later discovery of previously unknown problems with a product, including new safety risks from clinical or nonclinical data or manufacturing issues, may result in restrictions on the product or even complete withdrawal of the product from the market.

Nonclinical Tests and Clinical Trials

Nonclinical tests include laboratory evaluation of product chemistry and formulation, as well as animal testing to assess the potential safety and efficacy of the product. The conduct of the nonclinical tests and formulation of compounds for testing must comply with applicable federal regulations and requirements, including in some cases the FDA's good laboratory practice requirements and the Animal Welfare Act. The results of nonclinical testing are submitted to the FDA as part of an IND, together with chemistry, manufacturing and controls, or CMC, information, analytical and stability data, a proposed clinical trial protocol and other information. Clinical testing in humans may not commence until an IND is in effect.

An IND becomes effective 30 days after receipt by the FDA unless the FDA notifies the sponsor that the proposed investigation(s) are subject to a clinical hold. If the FDA imposes a clinical hold, or partial clinical hold, the FDA's concerns must be resolved prior to the commencement of clinical trials, or the FDA can enforce other changes to the clinical development program or clinical trial(s). The IND review process can result in substantial delay and expense. We, an IRB, or the FDA may, at any time, suspend, terminate, significantly modify, restrict or impose a clinical hold on ongoing clinical trials. If the FDA imposes a clinical hold, clinical trials cannot commence or recommence without FDA authorization, and then the clinical trials can commence or recommence only under the terms authorized by the FDA.

Clinical trials involve the administration of an investigational new drug to healthy volunteers or patients under the supervision of a qualified investigator. Clinical studies are conducted under protocols detailing, among other things, the objectives of the trial and the safety and effectiveness criteria to be evaluated. Each protocol involving testing on human subjects in the U.S. must be submitted to the FDA as part of the IND. In addition, clinical trials must be conducted in compliance with federal regulations and requirements, commonly referred to as good clinical practice, or GCP, to assure data integrity and protect the rights, safety and well-being of trial participants. Among other things, GCP requires that all research subjects provide their informed consent prior to participating in any clinical study, and that a properly constituted IRB for each institution participating in the clinical trial review and approve the plan for any clinical trial before it commences at that institution and conduct continuing review throughout the trial. The IRB must review and approve, among other things, the study protocol and informed consent information to be provided to study subjects.

Clinical trials to support NDAs are typically conducted in three sequential phases, which may overlap or be combined.

- In Phase 1, the initial introduction of the drug into healthy human subjects or patients, the drug is tested primarily to assess safety, tolerability, pharmacokinetics, pharmacological actions and metabolism associated with increasing doses.
- Phase 2 usually involves trials in a limited patient population, to assess the optimum dosage and dose regimen, identify possible adverse effects and safety risks, and provide preliminary support for the efficacy of the drug in the indication being studied.
- Phase 3 clinical trials further evaluate the drug's clinical efficacy, side effects and safety in an expanded patient population, typically at geographically dispersed clinical trial sites, to establish the overall benefit-risk relationship of the drug and to provide adequate information for the labeling of the drug.

Phase 1, Phase 2 or Phase 3 testing of any drug candidates may not be completed successfully within any specified time period, if at all. The FDA closely monitors the progress of each of the three phases of clinical trials that are conducted in the U.S. The FDA may, at its discretion, re-evaluate, alter, suspend or terminate the testing based upon the data accumulated to that point and the FDA's assessment of the risk/benefit ratio to the subject participating in the study. An IRB or a clinical trial sponsor may also modify, suspend or terminate clinical trials, or parts of clinical trials, at any time for various reasons, including a finding that the subjects or patients are being exposed to an unacceptable health risk. The FDA can also request or require that additional clinical trials, nonclinical evaluations or changes in the manufacturing process be conducted as a condition to product approval. Finally, sponsors are required to publicly disseminate information about certain ongoing and completed clinical trials on ClinicalTrials.gov, a government website administered by the National Institutes of Health, or NIH.

New Drug Applications

We believe that any RNAi product candidate we develop, whether for the treatment of ATTR amyloidosis, AHP, PH1, hypercholesterolemia or the various indications targeted in our clinical development or nonclinical discovery programs, will be regulated by the FDA as a new drug that is not considered to be a biologic, and thus will require an NDA. FDA approval of an

NDA is required before commercial distribution of a new drug may begin in the U.S. An NDA must include the results of extensive nonclinical, clinical and other testing, as described above, a compilation of data relating to the product's pharmacology, CMC, proposed labeling and other information. In addition, an NDA for a new active ingredient, new indication, new dosage form, new dosing regimen, or new route of administration typically must contain data assessing the safety and effectiveness for the claimed indication in all relevant pediatric subpopulations, although deferrals or full or partial waivers may be available in some circumstances.

The cost of preparing and submitting an NDA is substantial. Under the PDUFA, as amended, each NDA must be accompanied by an application fee. For fiscal year 2023, the application fee for each NDA requiring clinical data is approximately $3.2 million. The PDUFA also imposes an annual program fee for each approved prescription drug, which has been set at approximately $394,000 for fiscal year 2023. The FDA adjusts the PDUFA user fees on an annual basis. Fee waivers or reductions are available in certain circumstances. Additionally, no user fees are assessed on NDAs for products designated as orphan drugs, unless the NDA also includes a non-orphan indication. The FDA conducts a preliminary review of all NDAs within the first 60 days after submission before accepting them for filing to determine whether they are sufficiently complete to permit substantive review. During that time, the FDA may request additional information rather than accept an NDA for filing. If the FDA determines that an NDA is not sufficiently complete to permit substantive review, it will issue a refuse to file determination and the NDA will not be reviewed by the FDA. If the submission is accepted for filing, the FDA begins an in-depth review of the NDA. The FDA has agreed to specified performance goals regarding the timing of the completion of its review of NDAs, although the goals are not binding and the FDA does not always meet these goals. The review process is often significantly extended by the FDA's requests for additional information or clarification regarding information provided in the submission. For novel drug products or drug products that present difficult questions of safety or efficacy, the FDA may refer the application to an advisory committee, which is typically in the form of a panel that includes independent clinicians and other experts, for review, evaluation and a recommendation as to whether the application should be approved. The FDA may waive the review of an advisory committee and is not bound by the recommendation of an advisory committee, but it often follows such recommendations. The FDA normally conducts a pre-approval inspection to gain assurance that the manufacturing facility or facilities, methods and controls are adequate to preserve the drug's identity, strength, quality, purity and stability, and are in compliance with regulations governing current good manufacturing practice, or cGMP, requirements. In addition, the FDA often will conduct a bioresearch monitoring inspection of select clinical trial sites involved in conducting pivotal studies to assure data integrity and compliance with applicable GCP requirements, and could also conduct GCP inspections of the sponsor.

If the FDA's evaluation of an NDA and the various inspections are favorable, the FDA may issue an approval letter, which authorizes commercial marketing of the drug with specific prescribing information for a specific indication. The approved indication may be narrower than what was proposed by the applicant or for a narrower patient population than the population studied in clinical trials. As a condition of NDA approval, the FDA may require post-approval evaluations, sometimes referred to as Phase 4 trials, or other surveillance to monitor the drug's safety or effectiveness and may impose other conditions, including labeling restrictions, such as a Boxed Warning, and/or distribution and use restrictions through a Risk Evaluation and Mitigation Strategy, or REMS, all of which can materially affect the potential market and profitability of the drug. Once granted, product approvals may be further limited or withdrawn if compliance with regulatory standards is not maintained or safety or other problems are identified following initial marketing.

Post-Approval Regulation

Once an NDA is approved, a product will be subject to certain post-approval requirements, including requirements for manufacturing establishment registration and product listing, AE reporting, submission of other periodic reports, field alerts, recordkeeping, product sampling and distribution. Additionally, the FDA strictly regulates the promotional claims that may be made about prescription drug products and biologics. In particular, the FDA generally prohibits pharmaceutical companies from promoting their drugs or biologics for uses that are not approved by the FDA as reflected in the product's approved labeling, and requires that important safety information be presented to balance information provided on a drug's effectiveness. In addition, the FDA requires substantiation of any safety or effectiveness claims, including claims that one product is superior in terms of safety or effectiveness to another. Superiority claims generally must be supported by head-to-head clinical trials. To the extent that market acceptance of our products depends on their superiority over existing therapies, any restriction on our ability to advertise or otherwise promote claims of superiority, or requirements to conduct additional expensive clinical trials to provide proof of such claims, could negatively affect the sales of our products or our costs. We must also notify the FDA of any change in an approved product beyond variations in the approved application. Certain changes to the product, its labeling or its manufacturing require prior FDA approval and may require the conduct of further clinical investigations to support the change. Such approvals may be expensive and time-consuming and, if not approved, the FDA will not allow the product to be commercially distributed as modified.

If the FDA's evaluation of an NDA submission or GCP inspections or inspection of the manufacturing facilities for the product are not favorable or cannot be completed due to COVID-19 related restrictions, the FDA may defer action on an application or refuse to approve the NDA and issue a complete response letter. The complete response letter describes the deficiencies that the FDA has identified in an application and may recommend actions that the applicant can take to address the deficiencies. Such actions may include, among other things, conducting additional safety or efficacy studies. Even with the

completion of this additional testing or the submission of additional requested information, however, the FDA ultimately may decide that the application does not satisfy the regulatory criteria for approval. With limited exceptions, the FDA may withhold approval of an NDA regardless of prior advice it may have provided or commitments it may have made to the sponsor.

Some of our product candidates may need to be administered using specialized drug delivery systems that are considered to be medical devices. We may rely on drug delivery systems that are already approved or cleared to deliver drugs like ours to similar physiological sites or, in some instances, we may need to modify the design or labeling of the legally available device for delivery of our product candidate. The FDA may regulate our product candidate when used with a specialized drug delivery system as a combination product, which could permit the combination to be approved through a single application, such as an NDA. In some instances, the FDA could require separate, additional approvals or clearances for the modified device. If the FDA does require separate, additional approvals or clearances for the modified device, the FDA could require either a premarket approval application, or PMA, a 510(k) clearance, or a *de novo* classification, depending on the risk classification of the modified device and the availability of legally marketed predicate devices. Approval of PMAs are required for class III medical devices, which are devices for which insufficient information exists to provide reasonable assurance of the safety and effectiveness of the device through general controls and special controls. PMAs must contain sufficient valid scientific evidence to assure that the device is safe and effective for its intended use. Clearance under section 510(k) of the FDCA is required for most class II medical devices, which are devices for which special controls are necessary to provide reasonable assurance of safety and effectiveness. A 510(k) submission demonstrates to the FDA that the device is substantially equivalent (i.e., at least as safe and effective based on the intended use and technological characteristics) as a legally marketed predicate device that is not subject to PMA requirements. If no such legally marketed predicate device exists, but the applicant believes the device should not be automatically classified into class III, the applicant can submit an application for *de novo* classification, which is a request to FDA to classify the device into class I or II based on certain general and, if applicable, special controls that are necessary to provide reasonable assurance of safety and effectiveness of the device. In addition, if the FDA requires a separate, additional approval or clearance for a delivery device to be used with our products, and the delivery device is owned by another company, we will need that company's cooperation to implement the necessary changes to the device and to obtain any additional approvals or clearances, described above. Obtaining such additional approvals or clearances, and cooperation of other companies, when necessary, could significantly delay, and increase the cost of obtaining marketing approval, which could reduce the commercial viability of a product candidate. To the extent that we rely on previously unapproved drug delivery systems, we may be subject to additional testing and approval requirements from the FDA above and beyond those described above.

Abbreviated Applications and 505(b)(2) Applications

Once an NDA is approved, the product covered thereby becomes a listed drug that can, in turn, be relied upon by potential competitors in support of approval of an abbreviated NDA, or ANDA, or a 505(b)(2) application. An ANDA generally provides an abbreviated approval pathway for a drug product that has the same active ingredients in the same strength, dosage form and route of administration as the listed drug and has been shown through appropriate testing (unless waived) to be bioequivalent to the listed drug. Drugs approved in this way are commonly referred to as generic equivalents to the listed drug and can often be substituted by pharmacists under prescriptions written for the original listed drug. A 505(b)(2) application is a type of NDA that relies, in part, upon data the applicant does not own and to which it does not have a right of reference. Such applications often are submitted for changes to previously approved drug products.

The approval of ANDAs and 505(b)(2) applications can be delayed by patents and non-patent exclusivity covering the listed drug. Federal law provides for a period of three years of exclusivity following approval of a listed drug that contains a previously approved active ingredient if the FDA determines that new clinical investigations, other than bioavailability studies, were conducted or sponsored by the applicant and are essential to the approval of the application. This three-year exclusivity covers only the conditions of approval for which the new clinical investigations were essential, such as a new dosage form or indication. Accordingly, three-year exclusivity generally protects changes to a previously approved drug product that require clinical testing for approval and, as a general matter, does not prohibit the FDA from approving ANDAs or 505(b)(2) applications for generic versions of the drug product without such changes.

Federal law also provides a five-year period of NCE exclusivity following approval of a drug that contains an NCE. An NCE is a drug that contains an active moiety (the molecule or ion responsible for the action of the drug substance) that has never previously been approved by the FDA. If a listed drug has NCE exclusivity, ANDAs and 505(b)(2) applications referencing the listed drug cannot be submitted to the FDA for five years following the approval of the listed drug unless the application contains a certification challenging a listed patent, i.e., a paragraph IV certification (discussed further below), in which case the ANDA or 505(b)(2) application may be submitted four years following approval of the listed drug. Five-year and three-year exclusivity will not delay the submission or approval of a full NDA; however, an applicant submitting a full NDA would be required to conduct or obtain a right of reference to all of the nonclinical studies and clinical trials necessary to demonstrate safety and effectiveness.

Additionally, applicants submitting an ANDA or 505(b)(2) application referencing a listed drug generally are required to make a certification with respect to each patent for the listed drug that is listed in the FDA's publication Approved Drug Products with Therapeutic Equivalence Evaluations, commonly referred to as the Orange Book. If the applicant is not seeking

approval of a use claimed by a method-of-use patent, however, the applicant can submit a statement to that effect instead of making the certification. These certifications (and statements) affect when the FDA can approve the ANDA or 505(b)(2) application. If the ANDA or 505(b)(2) applicant certifies that it does not intend to market its product before a listed patent expires (i.e., a paragraph III certification), then the FDA will not grant effective approval of the ANDA or 505(b)(2) application until the relevant patent expires. If the ANDA or 505(b)(2) applicant certifies that a listed patent is invalid, unenforceable, or will not be infringed by its proposed product, and thus that it is seeking approval prior to patent expiration (i.e., a paragraph IV certification), and certain other steps are taken, then approval of the ANDA or 505(b)(2) application will be stayed (i.e., FDA will not approve the application) until 30 months have passed or patent disputes are resolved. Specifically, under the process set forth by the statute, the ANDA or 505(b)(2) applicant must provide notice of its patent challenge to the NDA sponsor and the patent holder within certain time limits. If the patent holder then initiates a suit for patent infringement within 45 days of receipt of the notice, the FDA cannot grant effective approval of the ANDA or 505(b)(2) application until either 30 months have passed (which may be extended or shortened in certain cases) or there has been a court decision or settlement order holding or stating that the patents in question are invalid, unenforceable or not infringed. If the court decision or settlement order holds or states that the patents in question are valid, enforceable, and would be infringed, however, then the ANDA or 505(b)(2) application may not be approved until such patents expire. If the patent holder does not initiate a suit for patent infringement within the 45-day time limit described above, the ANDA or 505(b)(2) application may be approved immediately upon successful completion of FDA review, unless blocked by another listed patent or regulatory exclusivity period.

Orphan Drug Designation

Under the Orphan Drug Act, as amended, the FDA may grant Orphan Drug Designation to a drug intended to treat a rare disease or condition, which is a disease or condition that affects fewer than 200,000 individuals in the U.S. or affects more than 200,000 individuals and for which there is no reasonable expectation of recovering drug development costs in the U.S. from sales in the U.S. Orphan Drug Designation must be requested before submitting an NDA or an sNDA for the orphan indication. After the FDA grants Orphan Drug Designation, the identity of the therapeutic agent and its potential orphan use are disclosed publicly by the FDA. We intend to request Orphan Drug Designation for our product candidates, if applicable. For example, the FDA granted Orphan Drug Designation for patisiran and vutrisiran as therapeutic approaches for the treatment of ATTR amyloidosis, givosiran as a therapeutic approach for AHP, lumasiran as a therapeutic approach for PH1, fitusiran as a therapeutic approach for hemophilia A and B, and inclisiran as a therapeutic approach for HoFH.

If a product that has Orphan Drug Designation subsequently receives the first FDA approval for the disease for which it has such designation, the product is entitled to Orphan Drug Exclusivity, which means that the FDA may not approve for seven years any other applications, including a full NDA, to market the "same drug" for the same indication, except in limited circumstances. For purposes of small molecule drugs, the FDA defines "same drug" as a drug that contains the same active moiety and is intended for the same use as the previously approved orphan drug. For purposes of large molecule drugs, the FDA defines "same drug" as a drug that contains the same principal molecular structural features, but not necessarily all of the same structural features, and is intended for the same use as the previously approved drug. Notwithstanding the above definitions, a drug that is "clinically superior" to an orphan drug will not be considered the "same drug" and thus will not be blocked by Orphan Drug Exclusivity. To demonstrate a drug is "clinically superior" to the previously approved orphan drug, a sponsor must show that the drug provides a significant therapeutic advantage over and above the previously already approved drug in terms of greater efficacy, greater safety, or by providing a major contribution to patient care.

A designated orphan drug may not receive Orphan Drug Exclusivity for a use that is broader than the indication for which it received Orphan Drug Designation and regulatory approval. In addition, Orphan Drug Exclusivity may be lost if the FDA later determines that the Orphan Drug Designation request was materially defective or if the manufacturer is unable to assure sufficient quantities of the drug to meet the needs of patients with the rare disease or condition, or if the manufacturer chooses to provide consent to approval of other applications.

Pediatric Study Plans

The FDCA requires that a sponsor who is planning to submit a marketing application for a drug or biological product that includes a new active ingredient, new indication, new dosage form, new dosing regimen or new route of administration submit an initial Pediatric Study Plan, or PSP, within sixty days of an end-of-phase 2 meeting or as may be agreed between the sponsor and the FDA. Drugs with Orphan Drug Designation are exempt from these requirements to the extent that the indication being sought under the marketing application is within the scope of the designated orphan use. The initial PSP must include an outline of the pediatric study or studies that the sponsor plans to conduct, including study objectives and design, age groups, relevant endpoints and statistical approach, or a justification for not including such detailed information, and any request for a deferral of pediatric assessments or a full or partial waiver of the requirement to provide data from pediatric studies along with supporting information. The FDA and the sponsor must reach agreement on the initial PSP. A sponsor can submit amendments to an agreed-upon initial PSP at any time if changes to the PSP need to be considered based on data collected from nonclinical studies, early phase clinical trials, and/or other clinical development programs.

Fast Track Program

The FDA has a Fast Track program that is intended to facilitate development and expedite the process for reviewing new drugs and biological products that meet certain criteria. Specifically, new drugs and biological products are eligible for Fast Track designation if they are intended to treat a serious or life-threatening condition and demonstrate the potential to address unmet medical needs for the condition. Fast Track designation applies to the product and the specific indication for which it is being studied. The sponsor of a new drug or biological product may request the FDA to designate the drug or biologic as a Fast Track product at any time during the clinical development of the product, but ideally no later than the pre-NDA or pre–biologics license application meeting because many of the features of Fast Track designation will not apply after that time. Fast Track designation provides opportunities for frequent interactions with FDA to expedite drug development and review as well as the opportunity for rolling review of the NDA. We intend to request Fast Track designation for our product candidates, if applicable. For example, the FDA granted Fast Track designation to patisiran for the treatment of hATTR amyloidosis, which was approved in August 2018 for the treatment of the polyneuropathy of hATTR amyloidosis in adults, and also granted Fast Track designation to vutrisiran for the treatment of the polyneuropathy of hATTR amyloidosis, which was approved in June 2022.

Any drug or biological product that receives a Fast Track designation may be eligible for other types of FDA programs intended to expedite development and review, such as priority review and accelerated approval. A drug or biological product is eligible for priority review if it treats a serious condition and, if approved, would provide a significant improvement in the safety or effectiveness of treatment, diagnosis or prevention of a disease compared to available therapies. The FDA's goal for taking action on an application with a priority review designation is six months from the date of receipt, instead of ten months from the date of receipt, except that two months are added to these time periods for drugs that contain a new molecular entity. Additionally, a drug or biological product may be eligible for accelerated approval if it is intended to treat a serious or life-threatening disease or condition, and the product would provide meaningful therapeutic benefit over existing treatments. Under accelerated approval, a product may be approved on the basis of adequate and well-controlled clinical studies establishing that the product has an effect on a surrogate endpoint that is reasonably likely to predict a clinical benefit, or on the basis of an effect on a clinical endpoint that can be measured earlier than irreversible morbidity or mortality and that is reasonably likely to predict an effect on irreversible morbidity or mortality or other clinical benefits. As a condition of approval, the FDA may require that a sponsor of a drug or biological product receiving accelerated approval perform adequate and well-controlled post-marketing clinical studies to verify the predicted clinical benefit and, under the Food and Drug Omnibus Reform Act of 2022, or FDORA, the FDA is now permitted to require, as appropriate, that such trials be underway prior to approval or within a specific time period after the date of approval for a product granted accelerated approval. Under FDORA, the FDA has increased authority for expedited procedures to withdraw approval of a drug or indication approved under accelerated approval if, for example, the confirmatory trial fails to verify the predicted clinical benefit of the product. In addition, the FDA requires as a condition for accelerated approval advance submission of promotional materials prior to use, which could limit or delay the commercial launch of the product. Fast Track designation, priority review and accelerated approval do not change the standards for approval but may expedite the development or approval process.

Breakthrough Therapy Designation

A drug or biological product can be designated as a breakthrough therapy if it is intended to treat a serious or life-threatening disease or condition and preliminary clinical evidence indicates that it may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints. A sponsor may request that a drug or biological product be designated as a breakthrough therapy at any time during the clinical development of the product and ideally before initiation of the pivotal clinical trial intended to serve as the primary basis for demonstration of efficacy to obtain the full benefits of the designation. If so designated, the FDA shall act to expedite the development and review of the product's marketing application, including by meeting with the sponsor throughout the product's development, providing timely advice to the sponsor to ensure that the development program is as efficient as practicable, involving senior managers and experienced review staff in a cross-disciplinary review, assigning a cross-disciplinary project lead for the FDA review team to facilitate an efficient review of the development program and to serve as a scientific liaison between the review team and the sponsor, taking steps to ensure that the design of the clinical trials is as efficient as practicable, and allowing a rolling review of the marketing application. The FDA granted breakthrough therapy designation for patisiran, approved in August 2018, givosiran, approved in November 2019, as well as lumasiran, approved in November 2020. We intend to request breakthrough therapy designation for our other product candidates, if applicable.

Rare Pediatric Disease Designation and Priority Review Voucher

In addition, the FDCA provides a rare pediatric disease priority review voucher, or PRV, program. The program is intended to incentivize the development of new drug and biological products for the prevention and treatment of "rare pediatric diseases," that is, any disease that is a rare disease and is serious or life-threatening with the serious or life-threatening manifestations primarily affecting individuals from birth to 18. Under this program, the sponsor of an application for a rare pediatric disease drug may be eligible to obtain a voucher that can be used to obtain a priority review for a subsequent human drug application. The FDA recommends that a sponsor request rare pediatric disease designation before submission of the rare pediatric disease product application. The rare pediatric disease designation does not guarantee that the sponsor will receive a

PRV. The FDA will award a PRV upon approval of the marketing application if the sponsor requests such a voucher in their marketing application and if the application meets the eligibility criteria. If awarded, the PRV may be transferred unlimited times. The rare pediatric disease PRV program was initially created in 2012, and Congress has extended the PRV program through September 30, 2024, with the potential for PRVs to be granted through September 30, 2026. The FDA awarded a rare pediatric disease PRV to us upon approval of the NDA for lumasiran in November 2020.

Pharmaceutical Coverage, Pricing and Reimbursement

Significant uncertainty exists as to the coverage and reimbursement status of any drug products for which we obtain regulatory approval. In the U.S. and markets in other countries, sales of any products for which we may receive regulatory approval for commercial sale will depend in part on the availability of reimbursement from third-party payors. Third-party payors include government healthcare programs, managed care providers, private health insurers and other organizations. The process for determining whether a payor will provide coverage for a drug product may be separate from the process for setting the price or reimbursement rate that the payor will pay for the drug product. Third-party payors may limit coverage to specific drug products on an approved list, or formulary, which might not include all of the FDA-approved drugs for a particular indication. Third-party payors may provide coverage, but place stringent limitations on such coverage, such as requiring alternative treatments to be tried first. These third-party payors are increasingly challenging the price and examining the medical necessity and cost-effectiveness of medical products and services, in addition to their safety and efficacy. In addition, significant uncertainty exists as to the reimbursement status of newly approved healthcare products. We may need to conduct expensive healthcare economic studies in order to demonstrate the medical necessity and cost-effectiveness of our products, in addition to incurring the costs required to obtain FDA approvals. Our product candidates may not be considered medically reasonable or necessary or cost-effective. Even if a drug product is covered, a payor's decision to provide coverage for a drug product does not imply that an adequate reimbursement rate will be approved. Lack of adequate third-party reimbursement may mean we are not able to maintain price levels sufficient to realize an appropriate return on our investment in product development. Factors payors consider in determining reimbursement are based on whether the product is:

- a covered benefit under its health plan;
- safe, effective and medically necessary;
- appropriate for the specific patient;
- cost-effective; and
- neither experimental nor investigational.

Federal, state and local governments in the U.S. and foreign governments continue to consider legislation to limit the growth of healthcare costs, including the cost of prescription drugs. Specifically, there have been several recent U.S. Congressional inquiries and proposed federal and state legislation designed to, among other things, bring more transparency to drug pricing, reduce the cost of prescription drugs under Medicare, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drugs. Future legislation could limit payments for pharmaceuticals such as the drug candidates that we are developing. Likewise, the Biden administration has indicated that lowering prescription drug prices is a priority, but we do not yet know what steps the administration will take or whether such steps will be successful.

The marketability of any products for which we receive regulatory approval for commercial sale may suffer if the government and third-party payors fail to provide adequate coverage and reimbursement. In addition, the emphasis on managed care in the U.S. has increased and we expect will continue to exert downward pressure on pharmaceutical pricing. Coverage policies, third-party reimbursement rates and pharmaceutical pricing regulations may change at any time. Even if favorable coverage and reimbursement status is attained for one or more products for which we receive regulatory approval, less favorable coverage policies and reimbursement rates may be implemented in the future.

In August 2022, the Inflation Reduction Act of 2022, or IRA, was signed into law. The IRA includes several provisions that will impact our business to varying degrees, including provisions that create a $2,000 out-of-pocket cap for Medicare Part D beneficiaries, impose new manufacturer financial liability on all drugs in Medicare Part D, allow the U.S. government to negotiate Medicare Part B and Part D pricing for certain high-cost drugs and biologics without generic or biosimilar competition, require companies to pay rebates to Medicare for drug prices that increase faster than inflation, and delay the rebate rule that would require pass through of pharmacy benefit manager rebates to beneficiaries.

The Patient Protection and Affordable Care Act, also referred to as the Affordable Care Act, or the ACA, enacted in 2010, includes measures that have significantly changed the way healthcare is financed by both governmental and private insurers. Among the provisions of the ACA of greatest importance to the pharmaceutical industry are the following:

- The Medicaid Drug Rebate Program requires pharmaceutical manufacturers to enter into and have in effect a national rebate agreement with the Secretary of the Department of Health and Human Services as a condition for states to receive federal matching funds for the manufacturer's outpatient drugs furnished to Medicaid patients. The ACA increased pharmaceutical manufacturers' rebate liability by raising the minimum basic Medicaid rebate on most branded prescription drugs and biologic products to 23.1% of average manufacturer price, or AMP, and added a new rebate calculation for "line extensions" (i.e., new formulations, such as extended release formulations) of solid oral

dosage forms of branded products, and modified the statutory definition of AMP. In addition, the ACA provides for the public availability of retail survey prices and certain weighted average AMPs under the Medicaid program. The implementation of this requirement by the Centers for Medicare and Medicaid Services, or CMS, may also provide for the public availability of pharmacy acquisition of cost data, which could negatively impact our sales.

- In order for a drug product to receive federal reimbursement under the Medicare Part B and Medicaid programs or to be sold directly to U.S. government agencies, the manufacturer must offer its innovator products on the Federal Supply Schedule for purchase at prices compliant with statutory and regulatory requirements and extend discounts to entities eligible to participate in the 340B drug pricing program. The required 340B discount on a given product is calculated based on the AMP and Medicaid rebate amounts reported by the manufacturer. The ACA expanded the types of entities eligible to receive discounted 340B pricing, although, under the current state of the law, with the exception of children's hospitals, these entities will not be eligible to receive discounted 340B pricing on orphan drugs. In addition, because 340B drug pricing is determined based on AMP and Medicaid rebate data, the revisions to the Medicaid rebate formula and AMP definition described above could cause the required 340B discount to increase.
- The ACA imposed a requirement on manufacturers of branded drugs and biologic products to provide a 50% discount off the negotiated price of branded drugs dispensed to Medicare Part D patients in the coverage gap (i.e., "donut hole"). Under the Bipartisan Budget Act of 2018, or the BBA, effective in 2019, the mandated manufacturer coverage gap discount increased to 70%.
- The ACA imposed an annual, nondeductible fee on any entity that manufactures or imports certain branded prescription drugs and biologic products; the fee is apportioned among these entities according to their market share in certain government healthcare programs. The fee would not apply to sales of certain products approved exclusively for orphan indications.
- The ACA created the Sunshine Act, which requires certain manufacturers to track certain financial arrangements with physicians and teaching hospitals, including any "transfer of value" made or distributed to such entities, as well as any investment interests held by physicians and their immediate family members. Legislation passed in 2018 expanded the scope of covered recipients' non-physician providers such as to physician assistants and advanced practice nurses, effective in 2022. Manufacturers annually report this information to CMS, which posts this information on its website.
- The ACA 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. The research conducted by the Patient-Centered Outcomes Research Institute may affect the market for certain drug products.
- The ACA 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.
- The law expands 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.

Since its enactment, there have been numerous judicial, administrative, executive, and legislative challenges to certain aspects of the ACA, and we expect there will be additional challenges and amendments to the ACA in the future. Various portions of the ACA are currently undergoing legal and constitutional challenges in the Fifth Circuit Court and the United States Supreme Court; the Trump Administration has issued various Executive Orders which have eliminated cost sharing subsidies and various other provisions that would impose a fiscal burden on states or a cost, fee, tax, penalty or regulatory burden on individuals, healthcare providers, health insurers, or manufacturers of pharmaceuticals or medical devices; and Congress has introduced several pieces of legislation aimed at significantly revising or repealing the ACA. It is unclear whether the ACA will be overturned, repealed, replaced, or further amended. We cannot predict what affect further changes to the ACA would have on our business.

Healthcare Fraud and Abuse

Federal and state laws generally prohibit the payment or receipt of kickbacks, bribes or other remuneration in exchange for the referral of patients or other healthcare-related business. For example, the Federal Anti-Kickback Statute prohibits anyone from, among other things, knowingly and willfully offering, paying, soliciting or receiving any bribe, kickback or other remuneration intended to induce the referral of patients for, or the purchase, order or recommendation of, healthcare products and services reimbursed by a federal healthcare program, including Medicare and Medicaid. Violations of this federal law can result in significant penalties, including imprisonment, monetary fines and assessments, and exclusion from Medicare, Medicaid and other federal healthcare programs. Exclusion of a manufacturer would preclude any federal healthcare program from paying for its products. In addition to the federal anti-kickback law, many states have their own laws that are analogous to the federal anti-kickback law, but may apply regardless of whether any federal or state healthcare program business is involved.

In addition, federal and state false claims laws prohibit anyone from presenting, or causing to be presented, claims for payment to third-party payers that are false or fraudulent. For example, the federal False Claims Act, or FCA, imposes liability

on any person or entity who, among other things, knowingly and willfully presents, or causes to be presented, a false or fraudulent claim for payment by a federal healthcare program, including Medicaid and Medicare. Some suits filed under the FCA, known as "qui tam" actions, can be brought by a "whistleblower" or "relator" on behalf of the government, and such individuals may share in any amounts paid by the entity to the government in fines or settlement. Manufacturers can be held liable under false claims laws, even if they do not submit claims to the government, where they are found to have caused submission of false claims by, among other things, providing incorrect coding or billing advice about their products to customers that file claims, or by engaging in kickback arrangements or off-label promotion with customers that file claims. In addition, the government may assert that a claim including items and services resulting from a violation of the U.S. federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the FCA. A number of states also have false claims laws, and some of these laws may apply to claims for items or services reimbursed under Medicaid and/or commercial insurance. Sanctions under these federal and state fraud and abuse laws may include civil monetary penalties and criminal fines, exclusion from government healthcare programs and imprisonment.

The Foreign Corrupt Practices Act of 1977, as amended, or FCPA, and similar worldwide anti-bribery laws in non-U.S. jurisdictions generally prohibit companies and their intermediaries from making improper payments to non-U.S. officials for the purpose of obtaining or retaining business. Violation of the FCPA could result in substantial civil and criminal penalties and remedies, including fines, disgorgement, and imprisonment.

As described above, the federal Sunshine Act requires manufacturers to report certain payments to healthcare providers to CMS. Many state laws require drug manufacturers to report similar information related to payments and other transfers of value provided to other healthcare providers. Some states prohibit these expenditures altogether. Laws in a number of states also require companies to adopt marketing codes of conduct, companies to disclose pricing information about their products, or pharmaceutical sales representatives to be licensed.

As described above, we maintain a global compliance program designed to support the execution of our business strategy and operations in compliance with these laws.

Possible Change in Laws or Policies

From time to time, legislation is drafted and introduced in Congress that could significantly change the statutory provisions governing the approval, manufacturing and marketing of drug products. In addition, FDA regulations and guidance are often revised or reinterpreted by the agency or reviewing courts in ways that may significantly affect our business and development of our product candidates and any products that we may commercialize. It is impossible to predict whether additional legislative changes will be enacted, or FDA regulations, guidance or interpretations will be changed, or what the impact of any such changes may be. Federal budget uncertainties or spending reductions may reduce the capabilities of the FDA, extend the duration of required regulatory reviews, and reduce the availability of clinical research grants.

Our present and future business has been and will continue to be subject to various other laws and regulations. Various laws, regulations and recommendations relating to safe working conditions, laboratory practices, the experimental use of animals, and the purchase, storage, movement, import, export and use and disposal of hazardous or potentially hazardous substances are or may be applicable to our activities. As noted above, the extent of government regulation, which might result from future legislation or administrative action, cannot accurately be predicted.

EU Regulatory Considerations

In the EU medicinal products are subject to extensive pre- and post-market regulation by regulatory authorities at both the EU and national levels.

Clinical Trials

Clinical trials of medicinal products in the EU must be conducted in accordance with EU and national regulations and the International Conference on Harmonization, or ICH, guidelines on GCP. If the sponsor of the clinical trial is not established within the EU, it must appoint an entity within the EU to act as its legal representative (unless all EU member states in which the trial is being conducted have chosen not to apply such rule, in which case only a contact person in the EU is required), who shall be responsible for ensuring compliance with the sponsor's obligations under the new EU Regulation on Clinical Trials and be the addressee for all communications provided for under the Regulation. The sponsor must take out a clinical trial insurance policy, and in most EU countries the sponsor is liable to provide 'no fault' compensation to any study subject injured in the clinical trial.

Prior to commencing a clinical trial, the sponsor must obtain approval of the CTA from the competent authority, and a positive opinion from an independent ethics committee. The application for a CTA must include, among other things, a copy of the trial protocol and an investigational medicinal product dossier containing information about the manufacture and quality of the medicinal product under investigation. Any substantial changes to the trial protocol or other information submitted with the CTAs must be notified to or approved by the relevant competent authorities and ethics committees.

Under the new EU Regulation on Clinical Trials, which became applicable on January 31, 2022, there is a centralized application procedure where one national authority leads the scientific review of the application leading to increased

information-sharing and decision-making between member states (as compared to the previous EU Directive on Clinical Trials, where a separate application to the competent authority in each EU member state in which the trial was conducted was required). Each concerned member state will continue to complete an ethical review of any CTA.

Information related to the product, patient population, phase of investigation, study sites and investigators, and other aspects of the clinical trial is made public by the competent authority once the CTA is approved. The results of the clinical trial must be submitted by the sponsor to the competent authorities and, with the exception of non-pediatric Phase 1 trials, will be made public at the latest within six months of the end of a pediatric clinical trial, or otherwise within 12 months after the end of the trial.

During the development of a medicinal product, the EMA and national medicines regulators within the EU provide the opportunity for dialogue and guidance on the development program. At the EMA level, this is usually done in the form of scientific advice, which is given by the Scientific Advice Working Party of the CHMP. A fee is incurred with each scientific advice procedure. Advice from the EMA is typically provided based on questions concerning, for example, quality (CMC testing), nonclinical testing and clinical studies, and pharmacovigilance plans and risk-management programs. Advice is not legally binding with regard to any future MAA of the product concerned.

Marketing Authorisations

After completion of the required clinical testing, we must obtain a marketing authorisation before we may place a medicinal product on the market in the EU. There are various application procedures available, depending on the type of product involved. All application procedures require an application in the common technical document format, which includes the submission of detailed information about the manufacturing and quality of the product, and nonclinical study and clinical trial information. There is an increasing trend in the EU towards greater transparency and, while the manufacturing or quality information is currently generally protected as confidential information, the EMA and national regulatory authorities are now liable to disclose much of the nonclinical and clinical information in marketing authorisation dossiers, including the full clinical study reports, in response to freedom of information requests after the marketing authorisation has been granted. As of October 2016, the EMA began publishing clinical data (including clinical study reports) on the agency's website following the grant, denial or withdrawal of an MAA for a centralised marketing authorisation, subject to procedures for limited redactions and protection against unfair commercial use.

The centralized procedure gives rise to marketing authorisations that are valid throughout the EU and, by extension (after national implementing decisions), in Norway, Iceland and Liechtenstein, which, together with the EU member states, comprise the European Economic Area, or EEA. Applicants file MAAs with the EMA, where they are reviewed by relevant scientific committees, including the CHMP. The EMA forwards CHMP opinions to the EC, which uses them as the basis for deciding whether to grant a marketing authorisation. The centralized procedure is compulsory for medicinal products that (1) are derived from biotechnology processes, (2) contain a new active substance indicated for the treatment of certain diseases, such as HIV/AIDS, cancer, diabetes, neurodegenerative disorders, viral diseases or autoimmune diseases and other immune dysfunctions, (3) are orphan medicinal products or (4) are advanced therapy medicinal products, such as gene or cell therapy medicines. For medicines that do not fall within these categories, an applicant may voluntarily submit an application for a centralized marketing authorisation to the EMA, as long as the CHMP agrees that (i) the medicine concerned contains a new active substance, (ii) the medicine is a significant therapeutic, scientific, or technical innovation, or (iii) the authorisation of the medicine under the centralized procedure would be in the interest of public health.

For those medicinal products for which the centralized procedure is not available, the applicant must submit MAAs to the national medicines regulators through one of three procedures: (1) a national procedure, which results in a marketing authorisation in a single EU member state; (2) the decentralized procedure, in which applications are submitted simultaneously in two or more EU member states; and (3) the mutual recognition procedure, which must be used if the product has already been authorised in at least one other EU member state, and in which the EU member states are required to grant an authorisation recognizing the existing authorisation in the other EU member state, unless they identify a serious risk to public health. A national procedure is only possible for one member state; as soon as an application is submitted in a second member state the mutual recognition or decentralized procedure will be triggered.

Under the centralized procedure in the EU, the maximum timeframe for the evaluation of an MAA is 210 days. However, this timeline excludes clock stops, when additional written or oral information is to be provided by the applicant in response to questions asked by the CHMP, so the overall process typically takes a year or more. Accelerated evaluation might be granted by the CHMP in exceptional cases, when a medicinal product is expected to be of a major interest for public health and therapeutic intervention, defined by the absence or insufficiency of an appropriate alternative therapeutic approach for the disease to be treated and anticipation of high therapeutic benefit of the new product. In this circumstance, the EMA ensures that the opinion of the CHMP is given within 150 days. The EMA granted an accelerated assessment for patisiran, which was approved in the EU in August 2018 under the centralized procedure.

Data Exclusivity

MAAs for generic medicinal products do not need to include the results of pre-clinical studies and clinical trials, but instead can refer to the data included in the marketing authorisation of a reference product for which regulatory data exclusivity has expired. If a marketing authorisation is granted for a medicinal product containing a new active substance, that product benefits from eight years of data exclusivity, during which generic MAAs referring to the data of that product will not be accepted by the regulatory authorities, and a further two years of market exclusivity, during which such generic products may not be placed on the market. The two-year market exclusivity period may be extended to three years if during the first eight years of the product's authorisation, a new therapeutic indication with significant clinical benefit over existing therapies is approved.

There is a special regime for biosimilars, or biological medicinal products that are similar to a reference medicinal product but that do not meet the definition of a generic medicinal product, for example, because of differences in raw materials or manufacturing processes. For such products, the results of appropriate pre-clinical studies or clinical trials must be provided, and guidelines from the EMA detail the type of supplementary data to be provided for different types of biological product. There are no such guidelines for complex biological products, such as gene or cell therapy medicinal products, and so it is unlikely that biosimilars of those products will currently be approved in the EU. However, guidance from the EMA states that they will be considered in the future in light of the scientific knowledge and regulatory experience gained at the time.

Orphan Medicinal Products

The EMA's Committee for Orphan Medicinal Products, or COMP, may recommend orphan medicinal product designation to promote the development of products that are intended for the diagnosis, prevention or treatment of life-threatening or chronically debilitating conditions affecting not more than five in 10,000 persons in the EU. Additionally, designation is granted for products intended for the diagnosis, prevention or treatment of a life-threatening, seriously debilitating or serious and chronic condition when, without incentives, it is unlikely that sales of the product in the EU would be sufficient to justify the necessary investment in developing the medicinal product. The COMP may only recommend orphan medicinal product designation when the product in question offers a significant clinical benefit over existing approved products for the relevant indication or where no satisfactory method of diagnosis, prevention or treatment of such condition exists. Following a positive opinion by the COMP, the EC adopts a decision granting orphan status. The COMP will reassess orphan status in parallel with EMA review of an MAA and orphan status may be withdrawn at that stage if it no longer fulfills the orphan criteria (for instance because in the meantime a new product was approved for the indication and no convincing data are available to demonstrate a significant benefit over that product). Orphan medicinal product designation entitles a party to financial incentives such as reduction of fees or fee waivers and ten years of market exclusivity is granted following marketing authorisation. During this period, the competent authorities may not accept or approve any similar medicinal product for the same therapeutic indication, unless (i) the second medicinal product is safer, more effective or otherwise clinically superior to the authorised orphan product; (ii) the marketing authorisation holder for the authorised product consents to a second orphan medicinal product application; or (iii) the marketing authorisation holder for the authorised product cannot supply enough orphan medicinal product. This period may be reduced to six years if the orphan medicinal product designation criteria are no longer met, including where it is shown that the product is sufficiently profitable not to justify maintenance of orphan designation. Patisiran, approved in the EU in August 2018, givosiran, approved in the EU in March 2020, lumasiran, approved in the EU in November 2020, as well as vutrisiran, approved in the EU in September 2022 and fitusiran have been granted orphan medicinal product designation.

Post-Approval Controls

The holder of a marketing authorisation must establish and maintain a pharmacovigilance system and appoint an individual qualified person for pharmacovigilance who is responsible for oversight of that system. Key obligations include expedited reporting of suspected serious adverse reactions and submission of periodic safety update reports, or PSURs.

All new MAAs must include a risk management plan, or RMP, describing the risk management system that the company will put in place and documenting measures to prevent or minimize the risks associated with the product. The regulatory authorities may also impose specific obligations as a condition of the marketing authorisation. Such risk-minimization measures or post-authorisation obligations may include additional safety monitoring, more frequent submission of PSURs, or the conduct of additional clinical trials or post-authorisation safety studies. RMPs and PSURs are routinely available to third parties requesting access, subject to limited redactions.

All advertising and promotional activities for the product must be consistent with the approved summary of product characteristics, and therefore all off-label promotion is prohibited. Direct-to-consumer advertising of prescription medicines is also prohibited in the EU. Although general requirements for advertising and promotion of medicinal products are established under EU directives, the details are governed by regulations in each member state and can differ from one country to another.

Manufacturing

Medicinal products may only be manufactured in the EU, or imported into the EU from another country, by the holder of a manufacturing authorisation from the competent national authority. The manufacturer or importer must have a qualified person

who is responsible for certifying that each batch of product has been manufactured in accordance with EU standards of cGMP before releasing the product for commercial distribution in the EU or for use in a clinical trial. Manufacturing facilities are subject to periodic inspections by the competent authorities for compliance with cGMP.

Pricing and Reimbursement

Governments influence the price of medicinal products in the EU through their pricing and reimbursement rules and control of national healthcare systems that fund a large part of the cost of those products to consumers. Some jurisdictions operate positive and negative list systems under which products may only be marketed once a reimbursement price has been agreed. To obtain reimbursement or pricing approval, some of these countries may require the completion of clinical trials that compare the cost-effectiveness of a particular product candidate to currently available therapies. Other member states allow companies to fix their own prices for medicines, but monitor and control company profits. The downward pressure on healthcare costs in general, particularly prescription medicines, has become very intense. As a result, increasingly high barriers are being erected to the entry of new products.

Regulation of New Drug Compounds in Other Jurisdictions

In addition to regulations in the U.S. and the EU, we are subject to a variety of regulations in other jurisdictions governing, among other things, clinical trials and any commercial sales and distribution of our products. In particular, during 2022, we filed for regulatory approval for our commercial products in a number of jurisdictions worldwide, and regulatory filings in additional countries are planned for ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO in 2023, and we will have to follow the specific regulations in such jurisdictions and such other countries in which we file, which are complex.

Whether or not we obtain FDA approval for a product, we must obtain the requisite approvals from regulatory authorities in all or most foreign countries prior to the commencement of clinical trials or marketing of the product in those countries. Certain countries outside of the U.S. have a similar process that requires the submission of a CTA, much like the IND prior to the commencement of human clinical trials. Once the CTA is approved in accordance with a country's requirements, clinical trial development may proceed. Similarly, all clinical trials in Australia require, among other things, review and approval of clinical trial proposals by an ethics committee, which provides a combined ethical and scientific review process.

In Canada, for example, authorization for clinical trials of pharmaceuticals is obtained by way of CTAs. Health Canada (the regulator in Canada that regulates, among other things, research, testing, manufacture and marketing of pharmaceuticals) approval is required for clinical trials using pharmaceuticals not authorized for sale in Canada (e.g., Phases I to III clinical trials and comparative bioavailability studies), and for trials of marketed pharmaceuticals where the proposed use is outside the marketing authorization. In addition, Research Ethics Boards, or REBs, oversee the conduct of clinical trials in Canada, and REB approval is required for each clinical trial site prior to commencing the trial at that site. Post-approval, both Health Canada and the REBs monitor the safety data of the clinical trials and assess serious adverse reactions filed throughout the trial. Health Canada may conduct site inspections to verify whether the conduct of a trial meets the requirements of GCP. An REB may impose conditions in relation to the conduct of clinical trials, and may require the informed consent used in the trial to be amended to address ethical concerns and privacy considerations.

Likewise, in Brazil, if a human clinical trial is to be carried out within the country's territory, in addition to the CTA-like authorization and the approval by an ethics committee, the commencement of the trials may also depend on the approval by a biosecurity commission.

The requirements and process governing the conduct of clinical trials varies from country to country. In all cases, however, the clinical trials must be conducted in accordance with GCP, which have their origin in the World Medical Association's Declaration of Helsinki, the applicable regulatory requirements, and guidelines developed by the ICH for GCP in clinical trials.

The approval procedure also varies among countries and can involve requirements for additional testing. The time required may differ from that required for FDA approval and may be longer than that required to obtain FDA approval. Thus, there can be substantial delays in obtaining required approvals from foreign regulatory authorities after the relevant applications are filed. Additionally, foreign governments lately are encouraging manufacturers to submit marketing applications in their jurisdictions with a variety of incentives including favorable reimbursement ratemaking. In Canada, while Health Canada has developed service standards for regulatory review time, those are target or estimated timelines that we can reasonably expect to receive from the regulator under normal circumstances, and as such, there may be delays in certain situations. In Brazil, obtaining the approval to begin human clinical trials can take from 180 to 360 days, and the marketing approval process itself usually takes between nine to 12 months. On the other hand, many countries have developed programs to expedite the approval of drugs pertaining to certain categories. In Brazil, for example, drugs designed to treat rare diseases can benefit from priority review and obtain marketing approval in less than six months.

With respect to marketing authorization, Canada typically approves pharmaceuticals by way of a Notice of Compliance, or NOC, together with a drug identification number, or DIN. NOCs are issued to pharmaceutical manufacturers following the satisfactory review of a new drug submission. Along with the NOC, a DIN is also issued to indicate the official approval and allow the sponsor to market the pharmaceutical in Canada. A DIN is an eight-digit number and uniquely identifies all pharmaceutical products sold in a dosage form in Canada. Additional obligations must be fulfilled when seeking marketing

authorization for biologic medicinal products (whether innovative biologics or biosimilars) in Canada. In addition to the information required for other pharmaceuticals, biologics must include more detailed chemistry and manufacturing information, which ensures the purity and quality of the product. Because slight variations in the manufacturing process can lead to a different product, sponsors must include details of the method of manufacturing in its submission.

Product pricing and reimbursement vary as well. Canada's pricing of patented pharmaceuticals is controlled by the Patented Medicine Prices Review Board, or PMPRB, whose regulatory authority is established by the Patented Medicines Regulations under Canada's Patent Act. The PMPRB is a regulatory board unique to Canada. Various other regulatory bodies are involved in the pricing of pharmaceuticals that are publicly funded, including the Canadian Agency for Drugs and Technologies in Health, the Institut national d'excellence en santé et en services sociaux, the pan Canadian Pharmaceutical Pricing Alliance, and public payors (e.g., provincial governments and territories). Each province of Canada has its own legislation relating to the pricing and reimbursement of pharmaceuticals, the permitted upcharges for wholesalers and pharmacies, the applicable dispensing fees, and whether rebates and professional allowances to pharmacies are prohibited or permitted. Approximately 40% of pharmaceuticals sold in Canada are paid for by the provincial (public) drug plans; the remainder are sold in the private market (e.g., covered by private insurance or paid for by individuals). The pricing of pharmaceuticals in the private market is less regulated than the pricing of pharmaceuticals in the public market.

In Brazil, price ceiling is government-regulated and must be approved by a specific commission prior to marketing. Since Brazil has a public health system that aims to provide free treatment and care to its whole population, public procurement follows a specific process that requires drugs to be included in the system's formularies prior to being distributed to patients cost-free.

If we fail to comply with applicable foreign regulatory requirements, we may be subject to, among other things, fines, suspension or withdrawal of regulatory approvals, product recalls, seizure of products, operating restrictions and criminal prosecution. In Canada, contravention of the federal Food and Drugs Act, or F&DA, (governs all aspects of the manufacturing, importing, labelling, distribution and sale of pharmaceuticals) and its regulations may result in various enforcement actions from Health Canada, including notice letters, request for plan for corrective measures, public advisories, additional restrictions to our licenses or product authorization, recall, seizure, forfeiture and destruction of our products, refusal, suspension, cancellation or revocation of our authorization, license or registration. In the event of a contravention of the F&DA, Health Canada determines the most appropriate level of intervention depending on the severity of the risk posed by regulatory non-compliance. In certain circumstances, the regulatory enforcement responses are not appropriate to achieve compliance, and Health Canada may investigate potential criminal offences under the F&DA and/or refer to law enforcement for prosecution in relation to offences under the F&DA and the Criminal Code of Canada. The F&DA contains criminal provisions which allow for the issuance of fines, a term of imprisonment, or both.

Hazardous Materials

Our research, development and manufacturing processes involve the controlled use of hazardous materials, chemicals and radioactive materials and produce waste products. We are subject to federal, state and local laws and regulations governing the use, manufacture, storage, handling and disposal of hazardous materials and waste products. We do not expect the cost of complying with these laws and regulations to be material.

Manufacturing

To date, we have manufactured limited supplies of drug substance for use in IND-enabling toxicology studies in animals and clinical trials at our own facilities, as well as patisiran formulated bulk drug product for late-stage clinical trial use and commercial supply. We have contracted with several third-party contract manufacturing organizations, or CMOs, for the supply of drug substance, drug product and finished product to meet our needs for pre-clinical toxicology studies, clinical and commercial supply. We expect to continue to rely on third-party CMOs for the supply of drug substance and drug product, including ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO, as well as other product candidates, for at least the next several years, including to support the potential launch of our additional product candidates and to supply the needs of our alliance partners. In 2015, we amended our manufacturing services agreement with Agilent Technologies, Inc., or Agilent, to provide for Agilent to supply, subject to any conflicting obligations under our third-party agreements, a specified percentage of the active pharmaceutical ingredients required for certain of our products in clinical development, as well as other products the parties may agree upon in the future. Under this agreement, we are required to provide rolling forecasts for products on a quarterly basis, a portion of which will be considered a binding, firm order. Agilent is required to reserve sufficient capacity to ensure that it can supply products in the amounts specified under such firm orders, as well as up to a certain percentage of the remaining, non-binding portions of each forecast. Subject to any conflicting obligations under our third-party agreements, we have also agreed to negotiate in good faith to enter into separate commercial manufacturing supply agreements with Agilent for certain products, consistent with certain specified terms, including a specified minimum purchase commitment. Currently, Agilent is the sole manufacturer of the active pharmaceutical ingredient for ONPATTRO, AMVUTTRA and GIVLAARI for both clinical and commercial use, and we have entered into manufacturing services agreements with Agilent for such supply of ONPATTRO, AMVUTTRA and GIVLAARI. Pursuant to the Agilent supply agreements, we are required to provide rolling forecasts on a quarterly basis, a portion of which will be considered a binding, firm order. Agilent is required to reserve

sufficient capacity to ensure that it can supply our commercial and clinical products in the amounts specified under such firm orders, including a certain percentage of the remaining, non-binding portions of each forecast, as well as a specified number of batches each year.

In 2012, we established a manufacturing facility and have developed cGMP capabilities and processes for the manufacture of patisiran formulated bulk drug product for late-stage clinical trial use and commercial supply. During 2013, we manufactured our first cGMP batch of patisiran for use in our Phase 2 OLE and Phase 3 clinical trials. We will continue to manufacture commercial supply for formulated bulk drug product for ONPATTRO in our facility for the foreseeable future. Commercial quantities of ONPATTRO and any other drugs that we may seek to develop will have to be manufactured in facilities, and by processes, that comply with FDA regulations and other federal, state and local regulations, as well as comparable foreign regulations.

During 2020, we completed construction and qualification of our cGMP manufacturing facility in Norton, Massachusetts where we currently manufacture drug substance for clinical programs and, eventually, intend to manufacture drug substance for commercial use. In December 2020, we began cGMP operations, and we believe this facility will enable us to initiate manufacturing for multiple new early-stage programs over the next few years, as well as provide us the manufacturing capabilities to support our late-stage and commercial programs in the future.

We believe we have sufficient manufacturing capacity through our third-party CMOs and our current internal manufacturing facilities to meet our current research, clinical and commercial needs and the needs of our alliance partners. We believe that the current supply capacity we have established externally, together with the internal capacity we developed to support pre-clinical trials, our existing facility for patisiran formulated bulk drug product and our Norton manufacturing facility, will be sufficient to meet our and our alliance partners' anticipated needs for the next several years. We monitor the capacity availability for the manufacture of drug substance and drug product and believe that our supply agreements with our CMOs and the lead times for new supply agreements would allow us to access additional capacity to meet our and our alliance partners' currently anticipated needs. We also believe that our products can be manufactured at a scale and with production and procurement efficiencies that will result in commercially competitive costs.

Commercial Operations

After successfully overcoming various challenges associated with developing a new class of innovative medicines - such as solving the issue of drug delivery, optimizing our RNAi therapeutics to exhibit potency and durability of effect, and designing and carrying out comprehensive clinical trials to demonstrate the safety and clinical efficacy of our investigational products - starting in 2018, we embarked on the next part of the company's journey: launching our RNAi therapeutics, based on regulatory approvals, to reach eligible patients in need. To that end, we have continued to build a global commercial operation which has been designed to be fully integrated and to sequentially manage multiple product launches across multiple geographies. Over the last several years, we have been building commercial capability and leveraging the internal knowledge we have accumulated as well as hiring talented people with broad industry experience to enable us to commercialize our products ourselves and with collaborators in key countries globally. The conduct of these commercial activities will continue to be dependent upon regulatory approvals and on agreements that we have made or may make in the future with strategic collaborators, currently as follows with respect to our first five approved products and our late-stage clinical programs:

- With respect to our ATTR amyloidosis franchise, we have global rights to develop and commercialize both ONPATTRO and AMVUTTRA;
- For GIVLAARI and OXLUMO, we have global rights to develop and commercialize;
- For Leqvio, we granted MDCO, which was acquired by Novartis in January 2020, global rights to develop and commercialize; and
- For fitusiran, Sanofi has global rights to develop and commercialize fitusiran and any back-ups as a result of the 2018 amendment to the Sanofi collaboration and the related product-specific license terms.

Throughout the development of our product candidates, we have remained focused on keeping patients at the center of everything we do. This patient focus has continued as we have transitioned into commercialization. ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO, as well as the late-stage programs we are advancing internally to commercialization are focused on orphan diseases, and we have been executing on what we believe to be a proven strategy to make ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO and future orphan products successful, including through efforts to increase awareness and diagnosis. In addition, as part of our planned transition to a top-tier biotech by the end of 2025 and consistent with our *Alnylam P^{5}x25* strategy, we are now advancing RNAi therapeutics beyond rare diseases into prevalent disease opportunities. Beginning with the approval of Leqvio, the first RNAi therapeutic approved for a common disease, we believe the RNAi therapeutic profile supports the potential for expansion to prevalent diseases, including addressing many unmet needs in common disease settings such as hypertension, NASH and diabetes. We believe we are establishing a global commercial organization and infrastructure to successfully support an expansion to prevalent diseases.

We have a proactive market access strategy that includes entering into value-based agreements, or VBAs, with commercial payers in the U.S. and certain state Medicaid programs. As of the beginning of 2023, we have completed over 40 VBAs with multiple commercial payers, including 19 for ONPATTRO, 11 for AMVUTTRA, 15 for GIVLAARI, and 15 for OXLUMO. In our VBAs for GIVLAARI we introduced a Prevalence Based Adjustment that provides for a rebate to be paid if the number of patients identified within a plan population exceeds the expected disease prevalence, to address an unknown that exists in the context of an ultra-rare disease. For OXLUMO, we established a new VBA component called a Patient Need Adjustment with the effect of providing payers with greater budget certainty for medicines administered across a broad range of patient age groups by paying a rebate if the average number of vials utilized by a plan member exceeds an established threshold. Discussions with additional payers continue for our marketed products. Outside of the U.S. we believe we have made strong progress in terms of patient access and have established availability of ONPATTRO in more than 20 countries through direct reimbursement or expanded access. In addition, we have seen strong early adoption of AMVUTTRA in key launch markets and expect continued expansion across global markets.

We are continuing to augment the key components of a global commercial organization with a focus on successfully launching our commercially approved products around the world and preparing for the anticipated commercial launches of additional RNAi therapeutics, assuming successful development and regulatory approval. With respect to commercially approved products, throughout 2022, we continued to build our commercial capabilities, including establishing field teams in the U.S. and other global markets, and are continuing to expand these capabilities to additional countries globally. We are continuing to build a focused commercial team with broad experience in marketing, sales, patient access, patient services, distribution and product reimbursement, in particular for orphan diseases. We are also continuing to incorporate and enhance the appropriate quality systems, compliance policies, systems and procedures, as well as implementing internal systems and infrastructure in order to support global commercial sales, and the establishment of patient-focused programs.

Ultimately, we intend to leverage the commercial infrastructure that we have built for our commercially approved products to also support the potential launch of patisiran in ATTR amyloidosis patients with cardiomyopathy, assuming regulatory approval. For many territories/countries, we may also elect to utilize strategic partners, distributors or contract sales forces to assist in the commercialization of our products. Our objective is to continue to execute successful product launches leveraging our positive experience with the launches of our commercially approved products.

Medical Affairs

Our Global Medical Affairs organization advances our efforts through stakeholder engagement, data dissemination, and healthcare professional education, ultimately enabling diagnosis and improving patient care. This begins with our efforts to engage patient groups and communities, improve disease awareness and increase patient diagnosis, including through support for independent third party genetic testing programs like Alnylam Act. With a scalable framework in these capabilities, we believe our Global Medical Affairs organization is well positioned to expand to prevalent diseases.

Human Capital Management

As of December 31, 2022, we employed 2,002 full-time employees, of whom approximately 1,570 were employed in the U.S. and approximately 432 were employed outside of the U.S. None of our employees in the U.S. are represented by a labor union or covered by collective bargaining agreements, and we believe our relationship with our employees is good. During 2022, we enhanced our capabilities by adding 337 new full-time employees. The new employees were hired to support a variety of functions and key initiatives, including extending our research, clinical and pre-clinical pipeline development, as well as our medical affairs, manufacturing and commercialization capabilities, with hires in commercial, compliance, legal, clinical development and operations, research, medical affairs, manufacturing, and general and administrative functions. We expect to continue to add additional employees in 2023, with a focus on further enhancing our capabilities and increasing our capacities in these areas, in particular our manufacturing, commercial and compliance teams, as well as expanding our geographic reach as we continue the global launches of our approved medicines and prepare for the potential launch of patisiran for patients with the cardiomyopathy of ATTR amyloidosis, assuming regulatory approval.

We consider the intellectual capital, skills and experience of our employees to be an essential driver of our business and key to our future prospects. We face intense competition for qualified individuals from numerous pharmaceutical and biotechnology companies, universities, governmental entities and other research institutions, and we believe that our future success will depend in large part on our continued ability to attract and retain highly skilled employees. To attract qualified applicants to our company and retain our employees, we offer a total rewards package consisting of base salary and cash target bonus targeting the 50th to 65th percentile of market based on geography, a comprehensive benefit package and equity compensation for every employee. Annual cash bonus opportunity and equity compensation increase as a percentage of total compensation based on level of responsibility. Any actual bonus payout is based solely on our performance against our corporate goals in the case of executive officers and is based on a combination of individual performance and corporate performance (or regional or national commercial performance metrics, as applicable) in the case of all other employees.

As a global commercial-stage biopharmaceutical company, we believe that our long-term success and ability to deliver innovative, safe and effective medicines to patients requires a diverse and inclusive workforce. We value diversity at all levels of the organization and continue to focus on extending our diversity, equity and inclusion initiatives across our entire

workforce, from: working with managers to develop strategies for building diverse, high performing teams; to ensuring that we attract, develop and retain diverse talent from all backgrounds; to increasing awareness within our company of unconscious biases, and supporting affinity groups comprised of individuals who are underrepresented in our company, industry or society, such as women, members of the LGBTQ community and people of color. In addition, we pride ourselves on an open culture that respects co-workers, values employees' health and well-being and fosters professional development. We support employee growth and development in a variety of ways including with group training, individual mentoring and coaching, conference attendance and tuition reimbursement. Our management conducts annual employee engagement surveys and reports to our board of directors on human capital management topics, including corporate culture, diversity, equity and inclusion, employee development and retention, and compensation and benefits. Similarly, our board of directors regularly provides input on important decisions relating to these matters, including with respect to employee compensation and benefits, talent retention and development.

Corporate Information

Alnylam Pharmaceuticals, Inc. is a Delaware corporation that was formed in May 2003. Alnylam U.S., Inc., one of our wholly owned subsidiaries, is also a Delaware corporation that was formed in June 2002 as our initial corporate entity. Our principal executive office is located at 675 West Kendall Street, Henri A. Termeer Square, Cambridge, Massachusetts 02142, and our telephone number is (617) 551-8200.

Investor Information

We maintain an internet website at http://www.alnylam.com. The information on our website is not incorporated by reference into this Annual Report on Form 10-K and should not be considered to be a part of this Annual Report on Form 10-K. Our website address is included in this Annual Report on Form 10-K as an inactive technical reference only. Our reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, including our annual reports on Form 10-K, our quarterly reports on Form 10-Q and our current reports on Form 8-K, and amendments to those reports, are accessible through our website, free of charge, as soon as reasonably practicable after these reports are filed electronically with, or otherwise furnished to, the United States Securities and Exchange Commission, or SEC. We also make available on our website the charters of our audit committee, people, culture and compensation committee, nominating and corporate governance committee, and science and technology committee, as well as our corporate governance guidelines and our code of business conduct and ethics. In addition, we intend to disclose on our web site any amendments to, or waivers from, our code of business conduct and ethics that are required to be disclosed pursuant to SEC rules.

The SEC maintains an Internet website that contains reports, proxy and information statements, and other information regarding Alnylam and other issuers that file electronically with the SEC. The SEC's Internet website address is http://www.sec.gov.

ITEM 1A. RISK FACTORS

We operate in an environment that involves a number of significant risks and uncertainties. We caution you to read the following risk factors, which have affected, and/or in the future could affect, our business, prospects, operating results, and financial condition. The risks described below include forward-looking statements, and actual events and our actual results may differ materially from these forward-looking statements. Additional risks and uncertainties not currently known to us or that we currently deem immaterial may also impair our business, prospects, operating results, and financial condition. Furthermore, additional risks and uncertainties are described under other captions in this report and should also be considered by our investors.

SUMMARY OF MATERIAL RISKS ASSOCIATED WITH OUR BUSINESS

Our business is subject to numerous risks and uncertainties, discussed in more detail in the following section. These risks include, among others, the following key risks:

Business Related Risks – Risks Related to Our Financial Results

- The marketing and sale of our approved products or any future products may be unsuccessful or less successful than anticipated and we may be unable to expand the indications for ONPATTRO and AMVUTTRA.
- We have a history of losses and may never become and remain consistently profitable.
- We will require substantial funds to continue our research, development and commercialization activities.
- The current pandemic of COVID-19 and its variants and the future outbreak of other highly infectious or contagious diseases, could continue to have an adverse impact on our business, financial condition and results of operations, including our commercial operations and sales, clinical trials and pre-clinical studies, and could impact other areas of our business as well.
- Although we sold a portion of the expected royalty stream and commercial milestones related to global sales of Leqvio by Novartis, we are entitled to retain the remaining portion of such future royalties and, if certain specified thresholds

are met, to the remaining portion of commercial milestone payments, and any negative developments related to Leqvio could have a material adverse effect on the timing or amount of those payments.

Risks Related to Our Dependence on Third Parties

- We may not be able to execute our business strategy if we are unable to maintain existing or enter into new alliances with other companies that can provide business and scientific capabilities and funds for the development and commercialization of certain of our product candidates.
- If any collaborator materially amends, terminates or fails to perform its obligations under agreements with us, the development and commercialization of certain of our product candidates could be delayed or terminated and we could suffer other economic harm.
- We have limited manufacturing experience and resources, and we must incur significant costs to develop this expertise and/or rely on third parties to manufacture our products.
- We rely on third parties to conduct our clinical trials, and if they fail to fulfill their obligations, our development plans may be adversely affected.

Risks Related to Managing Our Operations

- If we are unable to attract and retain qualified key management and scientists, development, medical and commercial staff, consultants and advisors, our ability to implement our business plan may be adversely affected.
- We may have difficulty expanding our operations successfully as we continue our evolution from a U.S.- and Europe-based company primarily involved in discovery, pre-clinical testing and clinical development into a global company that develops and commercializes multiple drugs in multiple geographies including Asia, Latin America and the Middle East.

Industry Related Risks – Risks Related to Development, Clinical Testing and Regulatory Approval of Our Product Candidates and the Commercialization of Our Approved Products

- Any product candidates we or our partners develop may fail in development or be delayed to a point where they do not become commercially viable.
- We or our partners may be unable to obtain U.S. or foreign regulatory approval for our or our partnered product candidates, or if approved, may fail to obtain desired labeling for such products.
- Even if we or our partners obtain regulatory approvals, our marketed drugs will be subject to ongoing regulatory oversight.
- Even if we receive regulatory approval to market our product candidates, and our collaborators receive regulatory approval to market product candidates discovered by us or developed with our technology, the market may not be receptive to such product candidates upon their commercial introduction, which could prevent us from becoming profitable.
- We are a multi-product commercial company and expect to continue to invest significant financial and management resources to continue to scale our marketing, sales, market access and distribution capabilities and further establish our global commercial and compliance infrastructure, and our commercial efforts may not be successful.
- We may incur significant liability if enforcement authorities allege or determine that we are engaging in commercial activities or promoting our commercially approved products in a way that violates applicable regulations, including in connection with the ongoing DOJ investigation.
- Any drugs we develop may become subject to unfavorable pricing regulations, third-party reimbursement practices or healthcare reform initiatives, thereby harming our business.

Risks Related to Patents, Licenses and Trade Secrets

- If we are not able to obtain and enforce patent protection for our discoveries, our ability to develop and commercialize our product candidates will be harmed.
- We license patent rights from third-party owners. If such owners do not properly or successfully obtain, maintain or enforce the patents underlying such licenses, our competitive position and business prospects may be harmed.
- Other companies or organizations may challenge our patent rights or may assert patent rights that prevent us from developing and commercializing our products.
- If we become involved in intellectual property litigation or other proceedings related to a determination of rights, including our ongoing patent infringement litigation against Pfizer, Inc., or Pfizer, and Moderna, Inc., we could incur

substantial costs and expenses, and in the case of such litigation or proceedings against us, substantial liability for damages or be required to stop our product development and commercialization efforts.

- If we fail to comply with our obligations under any licenses or related agreements, we may be required to pay damages and could lose license or other rights that are necessary for developing, commercializing and protecting our RNAi technology.

Risks Related to Competition

- The pharmaceutical market is intensely competitive. If we are unable to compete effectively with existing drugs, new treatment methods and new technologies, we may be unable to commercialize successfully any drugs that we or our collaborators develop.
- We face competition from other companies that are working to develop novel drugs and technology platforms using technology similar to ours, as well as from companies utilizing emerging technologies, including gene therapy and gene editing.

Risks Related to Our Common Stock

- If our stock price fluctuates, purchasers of our common stock could incur substantial losses.
- We may incur significant costs from class action litigation.
- Future sales of shares of our common stock, including by our significant stockholders, us or our directors and officers, could cause the price of our common stock to decline.

Risks Related to Our Convertible Notes

- Servicing our debt may require a significant amount of cash. We may not have sufficient cash flow from our business to pay our indebtedness.
- We may not have the ability to raise the funds necessary to settle for cash conversions of the Notes or to repurchase the Notes for cash upon a fundamental change, and our future debt may contain limitations on our ability to pay cash upon conversion of the Notes or to repurchase the Notes.
- The conditional conversion feature of the Notes, if triggered, may adversely affect our financial condition and operating results.

Risks Related to Our Business

Risks Related to Our Financial Results

The marketing and sale of our approved products or any future products may be less successful than anticipated, and we may be unable to expand the indications for ONPATTRO and AMVUTTRA.

In 2018, our first commercial product, ONPATTRO, was approved by the FDA and EMA, and we have since received approval and launched ONPATTRO in several additional territories. In 2019, the FDA approved our second product, GIVLAARI, which was also approved by the EMA and has since received approval in several additional territories, and in 2020, the FDA and EMA approved our third product, OXLUMO, which received additional regulatory approvals in 2021 and 2022. In June 2022, the FDA approved AMVUTTRA, which was granted marketing authorization in Europe and the UK in September 2022 and has since received regulatory approval in Japan and Brazil. We also have multiple product candidates in late-stage clinical development. While we have commercially launched four products, we cannot predict whether we will successfully market and sell our approved products, or successfully expand the indications of certain of our approved products. For example, in August and September 2022, we reported positive safety and efficacy results from the APOLLO-B Phase 3 clinical trial of patisiran, which was designed and powered to evaluate the effects of patisiran on functional capacity and quality of life in patients with ATTR amyloidosis with cardiomyopathy. While we believe that the APOLLO-B results after 12 months validate the therapeutic hypothesis of RNAi therapeutics targeting TTR as potential treatment for patients with ATTR amyloidosis with cardiomyopathy and submitted an sNDA to the FDA for review in December 2022, we cannot be certain that the results from the APOLLO-B clinical trial will support regulatory approval of patisiran for the treatment of patients with ATTR amyloidosis with cardiomyopathy.

To execute our business plan of building a profitable, top-tier biotech company over the next 5 years and achieving our *Alnylam P^{5}x25* strategy and the metrics associated with such strategy, in addition to successfully marketing, selling and expanding the indications of our approved products, we will need to successfully:

- execute product development activities and continue to leverage new technologies related to both RNAi and to the delivery of siRNAs to the relevant tissues and cells, including the liver, CNS, eye, lung and muscle;
- build and maintain a strong intellectual property portfolio;

- gain regulatory acceptance for the development and commercialization of our product candidates and market success for our approved products, as well as any other products we commercialize;
- attract and retain customers for our products;
- develop and maintain successful strategic alliances; and
- manage our spending as costs and expenses increase due to clinical trials, regulatory approvals and commercialization.

If we are unsuccessful in accomplishing the objectives set forth above, we may not be able to develop product candidates, successfully commercialize our approved products or any future products, raise capital, if needed, repay our indebtedness, achieve financial self-sustainability or continue our operations.

We have a history of losses and may never become and remain consistently profitable.

We have experienced significant operating losses since our inception. As of December 31, 2022, we had an accumulated deficit of $6.57 billion. Although to date we have launched four products in the U.S., EU and various other countries globally, and expect to launch our commercially approved products in additional countries during 2023 and beyond, we may never attain profitability or positive cash flow from operations. For the year ended December 31, 2022, we recognized $894.3 million in net product revenues from sales of ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO. While we believe 2019 was our peak operating loss year, we expect to continue to incur annual operating losses, and will require substantial resources over the next several years as we expand our efforts to discover, develop and commercialize RNAi therapeutics, and aim to achieve self-sustainability by the end of 2025. While we believe our current cash, cash equivalents and marketable equity and debt securities, as well as the revenue we expect to generate from product sales and under our current alliances, including milestones and royalties on Leqvio sales, should enable us to achieve a self-sustainable profile without the need for future equity financing, we will depend on our ability to generate revenues to achieve this goal. In addition to revenues derived from sales of our current and future, if any, commercially approved products, we anticipate that a portion of any revenues we generate over the next several years will continue to be from alliances with pharmaceutical and biotechnology companies, including Novartis and Regeneron. We cannot be certain that we will be able to maintain our existing alliances, secure and maintain new alliances, meet the obligations, or achieve any milestones that we may be required to meet or achieve to receive payments under our existing or new alliances. Moreover, we cannot be certain that our partners, including Novartis, will continue to successfully execute their obligations under our alliance agreements and generate additional revenues for us.

We believe that to become and remain consistently profitable, we must succeed in discovering, developing and commercializing novel drugs with significant market potential. This will require us to build upon the success we have had in a range of challenging activities, including continued platform innovation, pre-clinical testing and clinical trial stages of development, obtaining regulatory approval and reimbursement for these novel drugs and manufacturing, marketing and selling them. We may never generate revenues that are significant enough to achieve profitability and, even if we do achieve profitability, we may not be able to sustain or increase profitability on a quarterly or annual basis. If we cannot become and remain consistently profitable, the market price of our common stock could decline. In addition, we may be unable to raise capital, expand our business, develop additional product candidates or continue our operations.

We will require substantial funds to continue our research, development and commercialization activities and if the funds we require are greater than what we have estimated, we may need to critically limit or significantly scale back or cease certain of our activities.

We have used substantial funds to develop our RNAi technologies and will require substantial funds to conduct further research and development, including pre-clinical testing and clinical trials of our product candidates, and to manufacture, market and sell our four approved products and any other products that are approved for commercial sale. Because the length of time or activities associated with successful development of our product candidates, including zilebesiran, may be greater than we anticipate, we are unable to estimate the actual funds we will require to develop and commercialize them.

We believe 2019 was our peak operating loss year, and believe that our current cash, cash equivalents and marketable equity and debt securities, as well as revenue we expect to generate from product sales and under our current alliances, including milestones and royalties on Leqvio sales, will enable us to achieve a self-sustainable financial profile without need for future equity financing. However, our future capital requirements and the period for which we expect our existing resources to support our operations may vary from what we expect. We have based our expectations on a number of factors, many of which are difficult to predict or are outside of our control, including:

- progress in our research and development programs, including programs in both rare and prevalent diseases as well as what may be required by regulatory bodies to advance these programs;
- the timing, receipt and amount of milestone and other payments, if any, from present and future collaborators, if any, including milestone payments related to Leqvio, which is being commercialized by our partner, Novartis;
- our ability to maintain and establish additional collaborative arrangements and/or new business initiatives;

- the potential for improved product profiles to emerge from our new technologies and our ability to successfully advance our delivery efforts in extrahepatic tissues;
- the resources, time and costs required to successfully initiate and complete our pre-clinical and clinical studies, obtain regulatory approvals, prepare for global commercialization of our product candidates and obtain and maintain licenses to third-party intellectual property;
- our ability to establish, maintain and operate our own manufacturing facilities in a timely and cost-effective manner;
- our ability to manufacture, or contract with third parties for the manufacture of, our product candidates for clinical testing and commercial sale;
- the impact of COVID-19 or the ongoing conflict in Ukraine on the initiation or completion of pre-clinical studies or clinical trials and the supply of our products or product candidates;
- the resources, time and cost required for the preparation, filing, prosecution, maintenance and enforcement of patent claims;
- the costs associated with legal activities, including litigation and government investigations, arising in the course of our business activities and our ability to prevail or reach a satisfactory result in any such legal disputes and investigations;
- the timing, receipt and amount of sales and royalties, if any, from our approved products and our potential products, if and when approved; and
- the outcome of the regulatory review process and commercial success of drug products for which we are entitled to receive royalties, including Leqvio.

If our estimates, predictions and financial guidance relating to these factors are incorrect, we may need to modify our operating plan and may be required to seek additional funding in the future. We may do so through either collaborative arrangements, public or private equity offerings or debt financings, royalty or other monetization transactions or a combination of one or more of these funding sources. Additional funds may not be available to us on acceptable terms or at all.

The terms of any financing we may be required to pursue in the future may adversely affect the holdings or the rights of our stockholders. If we raise additional funds by issuing equity securities, further dilution to our existing stockholders will result. In addition, as a condition to providing additional funding to us, future investors may demand, and may be granted, rights superior to those of existing stockholders.

If we are unable to obtain additional funding on a timely basis, we may be required to significantly delay or curtail one or more of our research or development programs, or delay or curtail the further development of our global commercial infrastructure, and our ability to achieve our long-term strategic goals may be delayed or diminished. We also could be required to seek funds through arrangements with collaborators or others that may require us to relinquish rights to some of our technologies, product candidates or products that we would otherwise pursue on our own.

The COVID-19 pandemic and its variants, and the future outbreak of other highly infectious or contagious diseases, could continue to have an adverse impact on our business, financial condition and results of operations, including our commercial operations and sales, clinical trials and pre-clinical studies.

The ongoing COVID-19 pandemic continues to evolve and the ultimate impact of this pandemic remains uncertain. COVID-19 has and may continue to impact our operations and those of our third-party partners. The length of time and full extent to which the COVID-19 pandemic directly or indirectly impacts our business and financial results remains uncertain and cannot be predicted with confidence, and depends on future developments that are highly uncertain, subject to change and are difficult to predict, including as a result of new information that may emerge concerning COVID-19, new strains of the virus, including any future variants that may emerge, and the actions taken to contain or treat COVID-19, as well as the economic impact on local, regional, national and international markets.

In response to the spread of COVID-19, we took, and have continued to take, both temporary and ongoing precautionary measures, intended to help minimize the risk of the virus to our employees and their families, including implementing flexible work arrangements for nearly all employees who were able to perform their duties remotely. Working arrangements for many of our employees differ from the arrangements before the COVID-19 pandemic, and we expect a number of employees will continue to work in a remote capacity or a hybrid of in-person and remote work. We may face several challenges or disruptions as result of these working arrangements, and our hybrid of in-person and remote work option may negatively impact productivity, or disrupt, delay, or otherwise adversely impact our business. To the extent that we have less remote work opportunities and less flexibility than our competitors, our ability to attract and retain talent may be materially affected, which could adversely impact our employee recruitment and retention efforts. In addition, the increase in certain of our employees working remotely has amplified certain risks to our business, including increased demand on our information technology resources and systems, increased phishing and other cybersecurity attacks, and any failure to effectively manage these risks, including to timely identify and appropriately respond to any cyberattacks, could adversely impact our business operations.

If the conditions of the pandemic worsen, we may experience disruptions that could impact our business and operations, including our ability to successfully commercialize our approved products, and we may not be able to meet expectations with respect to commercial sales. In addition, we may also experience decreased patient demand for our approved products if current or potential patients decide to delay treatment as a result of the COVID-19 or a future pandemic. Business interruptions from the current or future pandemics, including staffing shortages, raw material or other supply chain shortages, production slowdowns and disruptions in delivery systems, may also adversely impact the third parties we or our partners rely on in the U.S. and abroad to sufficiently manufacture our approved products and to produce product candidates in quantities we require, which may impair our commercialization efforts, our research and development activities and the potential commercialization of our product candidates.

Additionally, timely completion of pre-clinical activities and initiation of planned clinical trials are dependent upon the availability of, for example, pre-clinical and clinical trial sites, researchers and investigators, patients or healthy volunteer subjects available for recruitment and enrollment, and regulatory agency personnel, which may be adversely affected by global health matters, such as the ongoing COVID-19 pandemic. We are conducting and plan to continue to conduct pre-clinical activities and clinical trials for our drug product candidates in geographies which have been and continue to be affected by COVID-19, and believe that the COVID-19 pandemic could continue to have an impact on various aspects of our ongoing clinical trials and on the clinical trials and pre-clinical studies we expect to initiate during 2023. For example, certain trial sites in some of our ongoing clinical trials were restricted temporarily by the institutions where they are located from scheduling patient visits or permitting onsite monitoring due to the COVID-19 pandemic, and in some of our ongoing trials, delayed or missed doses of study drug have been reported. Any business interruptions caused by the COVID-19 pandemic could also delay necessary interactions with local regulators, ethics committees, manufacturing sites, research or clinical trial sites and other important agencies and contractors, which could adversely impact the clinical trials of our product candidates.

Health regulatory agencies globally may also experience disruptions in their operations if the conditions of the COVID-19 pandemic worsen, which could impact review, inspection and approval timelines. Since March 2020, when foreign and domestic inspections of facilities were largely placed on hold, the FDA has been working to resume pre-pandemic levels of inspection activities, including routine surveillance, bioresearch monitoring and pre-approval inspections. Should the FDA determine that an inspection is necessary for approval of a marketing application and an inspection cannot be completed during the review cycle due to restrictions on travel, and the agency does not determine a remote interactive evaluation to be adequate, the FDA has stated that it generally intends to issue, depending on the circumstances, a complete response letter or defer action on the application until an inspection can be completed. For example, in December 2020, the FDA issued a complete response letter regarding Novartis' NDA for inclisiran, stating that the agency could not approve the NDA by the Prescription Drug User Free Act, or the PDUFA, action date due to unresolved facility inspection-related conditions. The FDA ultimately approved Novartis' NDA in December 2021. Regulatory authorities outside the U.S. may adopt similar restrictions or other policy measures in response to the ongoing COVID-19 pandemic and may experience delays in their regulatory activities.

Although we sold a portion of the royalty stream and commercial milestones from the global sales of Leqvio by our collaborator, Novartis, we are entitled to retain the remaining portion of future royalties from the global sales of Leqvio and, if certain specified thresholds are met, to the remaining portion of commercial milestone payments, and any negative developments related to Leqvio could have a material adverse effect on our receipt of those payments.

In April 2020, we sold to Blackstone 50% of the royalties payable to us with respect to net sales by Novartis, its affiliates or sublicensees of Leqvio and 75% of the commercial milestone payments payable to us under the MDCO agreement. If Blackstone does not receive royalty payments in respect of global sales of Leqvio equaling at least $1.00 billion by December 31, 2029, Blackstone's royalty interest will increase to 55% effective January 1, 2030. Our receipt of future royalty payments and a portion of commercial milestone payments may be negatively impacted if the Leqvio royalty stream and commercial milestones payments are insufficient to meet the specified thresholds. For example, in December 2020, the FDA issued a complete response letter regarding Novartis' NDA for inclisiran, stating that the agency could not approve the NDA by the PDUFA action date due to unresolved inspection-related conditions at a third party manufacturing facility, delaying the potential approval and launch of Leqvio in the U.S., as well as payment of an associated approval milestone and potential royalties. While Leqvio was granted marketing authorization by the EC in Europe in December 2020, and was approved by the FDA in December 2021, any negative impact to future royalty payments and commercial milestone payments could affect our ability to meet the specified repayment thresholds. Additional factors that may have an adverse effect on the Leqvio royalty stream and commercial milestones include:

- companies working to develop new therapies or alternative formulations of products for ASCVD;
- foreign currency movement, which could have a negative impact on Novartis' sales of Leqvio, thereby reducing the royalties;
- any negative developments relating to Leqvio, such as safety, efficacy, or reimbursement issues, could reduce demand for Leqvio;
- any disputes concerning patents, proprietary rights, or license and collaboration agreements could negatively impact our receipt of commercial milestone payments or royalties; and

- adverse regulatory or legislative developments could limit or prohibit the sale of Leqvio, such as restrictions on the use of Leqvio or safety-related label changes, including enhanced risk management programs, which may significantly reduce expected royalty revenue and commercial milestone payments and could require significant expense to address the associated legal and regulatory issues.

If the revenues generated by sales of Leqvio are lower than expected, our business could be materially adversely affected.

Geopolitical risks associated with the ongoing military conflict between Russia and Ukraine could have an adverse impact on our business, financial condition and results of operations, including our clinical trials.

Russia's invasion of Ukraine, and the global response, including the imposition of sanctions by the U.S., EU and other countries, may have an adverse impact on our business, including our clinical trials, the financial markets and the global economy. The uncertain nature, magnitude, and duration of hostilities stemming from the conflict in Ukraine, including the potential effects of sanctions limitations, retaliatory cyber-attacks on the world economy and markets, have also contributed to increased market volatility and uncertainty, which could have an adverse impact on macroeconomic factors that affect our business and operations.

Additionally, the ongoing conflict in Ukraine may disrupt the ability of our contract research organizations, or CROs, to conduct clinical trials at certain sites in Ukraine. Moreover, enrollment and retention of clinical trial participants may be adversely affected. We cannot be certain what the overall impact of this conflict will be on our ability to conduct and complete our clinical trials on schedule. However, interruptions of our clinical trials could significantly delay our clinical development plans and potential authorization or approval of our product candidates, which could increase our costs and jeopardize our ability to successfully commercialize our product candidates.

We expect our operating results to fluctuate in future periods, which may adversely affect our stock price.

Our quarterly operating results have fluctuated in the past, and may continue to do so in the future. Our operating results may fluctuate due to the impact of the COVID-19 and related variants or a future pandemic, the level of success of our commercial efforts and resulting revenues, as well as the variable nature of our operating expenses as a result of the timing and magnitude of expenditures. For example, due to the impact of the COVID-19 pandemic, combined net product revenues in the first quarter of 2022 for our commercially approved products were negatively impacted. In addition, in one or more future periods, our results of operations may fall below the expectations of securities analysts and investors. In that event, the market price of our common stock could substantially decline.

If the estimates we make, or the assumptions on which we rely, in preparing our consolidated financial statements and/or our projected guidance prove inaccurate, our actual results may vary from those reflected in our projections and accruals.

Our consolidated financial statements have been prepared in accordance with accounting principles generally accepted in the United States of America, or GAAP. The preparation of these consolidated financial statements requires us to make estimates and judgments that affect the reported amounts of our assets, liabilities, revenues and expenses, the amounts of charges accrued by us and related disclosure of contingent assets and liabilities. We base our estimates on historical experience and on various other assumptions that we believe to be reasonable under the circumstances. We cannot assure you, however, that our estimates, or the assumptions underlying them, will be correct.

Further, from time to time we issue financial guidance relating to our expectations regarding our combined product sales, collaboration and royalty revenues, and GAAP and non-GAAP combined research and development and selling, general and administrative expenses, which guidance is based on estimates and the judgment of management. If, for any reason, our revenues and/or expenses differ materially from our guidance, we may have to adjust our publicly announced financial guidance. For example, in April 2022, we decreased our 2022 guidance range for combined net product revenues, and in October 2022, we decreased our guidance range for our collaboration and royalty revenue. If we fail to meet, or if we are required to change or update any element of, our publicly disclosed financial guidance or other expectations about our business, our stock price could decline.

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

As of December 31, 2022, we had $2.19 billion in cash, cash equivalents and marketable securities. We historically have invested these amounts in high–grade corporate notes, commercial paper, securities issued or sponsored by the U.S. government, certificates of deposit and money market funds meeting the criteria of our investment policy, which is focused on the preservation of our capital. Corporate notes may also include foreign bonds denominated in U.S. dollars. These investments are subject to general credit, liquidity, market and interest rate risks. We may realize losses in the fair value of these investments or a complete loss of these investments, which would have a negative effect on our consolidated financial statements. In addition, should our investments cease paying or reduce the amount of interest paid to us, our interest income would suffer. The market risks associated with our investment portfolio may have an adverse effect on our results of operations, liquidity and financial condition.

Volatility in foreign currency exchange rates could have a material adverse effect on our operating results.

Our revenue from outside of the U.S. will increase as our products, whether commercialized by us or our collaborators, gain marketing approval in such jurisdictions. Our primary foreign currency exposure relates to movements in the Japanese yen, Euro and British pound. If the U.S. dollar weakens against a specific foreign currency, our revenues will increase, having a positive impact on net income, but our overall expenses will increase, having a negative impact. Conversely, if the U.S. dollar strengthens against a specific foreign currency, our revenues will decrease, having a negative impact on net income, but our overall expenses will decrease, having a positive impact. For example, during 2022, we experienced an unfavorable impact from foreign exchange rates on our international revenues. Continued volatility in foreign exchange rates is likely to impact our operating results and financial condition.

Changes in tax law could adversely affect our business and financial condition.

Our business is subject to numerous international, federal, state, and other governmental laws, rules, and regulations that may adversely affect our operating results, including, taxation and tax policy changes, tax rate changes, new tax laws, or revised tax law interpretations, which individually or in combination may cause our effective tax rate to increase. In the U.S., the rules dealing with federal, state, and local income taxation are constantly under review by persons involved in the legislative process and by the Internal Revenue Service and the U.S. Treasury Department. Changes to tax laws (which changes may have retroactive application) could adversely affect us or holders of our common stock. In recent years, many such changes have been made and changes are likely to continue to occur in the future. Future changes in tax laws could have a material adverse effect on our business, cash flow, financial condition or results of operations.

Additionally, the Organization for Economic Co-operation and Development, or OECD, the EC, and individual taxing jurisdictions where we and our affiliates do business have recently focused on issues related to the taxation of multinational corporations. The OECD has released its comprehensive plan to create an agreed set of international rules for fighting base erosion and profit shifting. In addition, the OECD, the EC and individual countries are examining changes to how taxing rights should be allocated among countries considering the digital economy. As a result, the tax laws in the U.S. and other countries in which we and our affiliates do business could change on a prospective or retroactive basis and any such changes could materially adversely affect our business.

Risks Related to Our Dependence on Third Parties

We may not be able to execute our business strategy if we are unable to maintain existing or enter into new alliances with other companies that can provide business and scientific capabilities and funds for the development and commercialization of our product candidates. If we are unsuccessful in forming or maintaining these alliances on terms favorable to us, our business may not succeed.

We are continuing to advance our commercial capabilities, including in marketing, sales, market access and distribution, to support our wholly-owned products. We also continue to advance our growing pipeline of RNAi therapeutic opportunities. However, we may not have adequate capacity or capabilities to advance all of our therapeutic opportunities. Accordingly, we have entered into alliances with other companies and collaborators that we believe can provide such capabilities in certain territories and/or for certain product candidates, and we intend to enter into additional such alliances in the future. Our collaboration strategy is to form alliances that create significant value for us and our collaborators in the advancement of RNAi therapeutics as a new class of innovative medicines. Specifically, with respect to our Genetic Medicine pipeline, as a result of our broad strategic alliance with Sanofi formed in 2014, Sanofi has the right to develop and commercialize fitusiran globally. In addition, we formed a collaboration with MDCO (which was acquired by Novartis in January 2020) to advance inclisiran. In March 2018, we entered into a discovery collaboration with Regeneron to identify RNAi therapeutics for NASH and potentially other related diseases, and in November 2018, we and Regeneron entered into a separate, fifty-fifty collaboration to further research, co-develop and commercialize any therapeutic product candidates that emerge from these discovery efforts. In October 2017, we announced an exclusive licensing agreement with Vir for the development and commercialization of RNAi therapeutics for infectious diseases, including chronic HBV infection. In April 2020, we entered into a development and commercialization collaboration with Dicerna (which was acquired by Novo Nordisk in December 2021) to advance investigational RNAi therapeutics for the treatment of alpha-1 liver disease. With respect to our CNS/Ocular Disease pipeline, in April 2019, we announced a global, strategic collaboration with Regeneron to discover, develop and commercialize RNAi therapeutics for a broad range of diseases by addressing therapeutic targets expressed in the eye and CNS, in addition to a select number of targets expressed in the liver.

In such alliances, we expect our current, and may expect our future, collaborators to provide substantial capabilities in clinical development, regulatory affairs, and/or marketing, sales and distribution. Under certain of our alliances, we also may expect our collaborators to develop, market and/or sell certain of our product candidates. We may have limited or no control over the development, sales, marketing and distribution activities of these third parties. Our future revenues may depend heavily on the success of the efforts of these third parties. For example, we will rely entirely on (i) Regeneron for the development and commercialization of all programs targeting eye diseases (subject to limited exceptions), and potentially other CNS and liver programs, (ii) Novartis for all future development and commercialization of Leqvio worldwide, and (iii) Sanofi for the development and commercialization of fitusiran worldwide. In the case of each such collaboration referenced in clauses (i)-(iii)

above, we are entitled to royalties on the sales of each of these products. If our collaborators are not successful in their development and/or commercialization efforts, our future revenues from RNAi therapeutics for these indications may be adversely affected. For example, while Leqvio was granted marketing authorization by the EC in Europe, in December 2020, Novartis received a complete response letter from the FDA stating that the agency could not approve the NDA by the PDUFA action date due to unresolved inspection-related conditions at a third party manufacturing facility. While Leqvio was approved by the FDA in December 2021, the resolution of the complete response letter resulted in a delay in the payment of an approval milestone and potential U.S. royalties. If the revenues generated by the royalties received by Blackstone from us with respect to Leqvio sales do not reach a certain level by the end of 2029, Blackstone will be entitled to a higher royalty percentage beginning in 2030, which would have an adverse impact on our revenues beginning in 2030.

We may not be successful in entering into future alliances on terms favorable to us due to various factors, including our ability to demonstrate improved product profiles from our new technologies, including our IKARIA and GEMINI platforms, our ability to successfully demonstrate proof-of-concept for our technology in humans in certain tissues or disease areas, including our alternative conjugate approach for delivering CNS or ocular product candidates or other extrahepatic approaches, our ability to demonstrate the safety and efficacy of our specific drug candidates, our ability to manufacture or have third parties manufacture RNAi therapeutics, the strength of our intellectual property and/or concerns around challenges to our intellectual property. For example, the occurrence of a fatal thrombotic serious adverse event, or SAE, in our fitusiran study in 2017 and a subsequent pause in dosing and enrollment in fitusiran clinical studies in 2020 could contribute to further concerns about the safety of specific therapeutic candidates or therapeutic candidates for specific diseases. Even when we succeed in securing such alliances, we may not be able to maintain them if, for example, development or approval of a product candidate is delayed, challenges are raised as to the validity or scope of our intellectual property, we are unable to secure adequate reimbursement from payors or sales of an approved drug are lower than we expected.

Furthermore, any delay in entering into collaboration agreements would likely either delay the development and commercialization of certain of our product candidates and reduce their competitiveness even if they reach the market, or prevent the development of certain product candidates. Any such delay related to our collaborations could adversely affect our business.

For certain product candidates, we have formed collaborations to fund all or part of the costs of drug development and commercialization, such as our collaborations with Regeneron, Novartis, Vir, Dicerna and Sanofi. We may not, however, be able to enter into additional collaborations for certain other programs, and the terms of any collaboration agreement we do secure may not be favorable to us. If we are not successful in our efforts to enter into future collaboration arrangements with respect to one or more of our product candidates, we may not have sufficient funds to develop these product candidates or other product candidates internally, or to bring our product candidates to market. If we do not have sufficient funds to develop and bring our product candidates to market, we will not be able to generate revenues from these product candidates, and this will substantially harm our business.

If any collaborator materially amends, terminates or fails to perform its obligations under agreements with us, the development and commercialization of our product candidates could be delayed or terminated.

Our dependence on collaborators for capabilities and funding means that our business could be adversely affected if any collaborator materially amends or terminates its collaboration agreement with us or fails to perform its obligations under that agreement. Our current or future collaborations, if any, may not be scientifically or commercially successful. Disputes may arise in the future with respect to the ownership of rights to technology or products developed with collaborators, which could have an adverse effect on our ability to develop and commercialize any affected product candidate. Our current collaborations allow, and we expect that any future collaborations will allow, either party to terminate the collaboration for a material breach by the other party. In addition, our collaborators may have additional termination rights for convenience with respect to the collaboration or a particular program under the collaboration, under certain circumstances. For example, our agreement with MDCO, which was acquired by Novartis in January 2020, relating to the development and commercialization of inclisiran worldwide may be terminated by Novartis at any time upon four months' prior written notice, provided if the agreement is terminated by Novartis for convenience, Novartis must grant a license to us under certain of our technology developed in the course of MDCO's activities under the agreement, subject to a royalty to be negotiated between the parties. Moreover, any adverse actions by Novartis with respect to the MDCO agreement or disputes with Novartis regarding each party's rights and obligations under the MDCO agreement could adversely impact our ability to comply with our obligations under our agreements with Blackstone. If we were to lose a commercialization collaborator, we would have to attract a new collaborator or develop expanded sales, distribution and marketing capabilities internally, which would require us to invest significant amounts of financial and management resources.

In addition, if we have a dispute with a collaborator over the ownership of technology or other matters, or if a collaborator terminates its collaboration with us, for breach or otherwise, or determines not to pursue the research, development and/or commercialization of RNAi therapeutics, it could delay our development of product candidates, result in the need for additional company resources to develop product candidates, require us to expend time and resources to develop expanded sales and marketing capabilities on a more expedited timeline, make it more difficult for us to attract new collaborators and could adversely affect how we are perceived in the business and financial communities.

Moreover, a collaborator, or in the event of a change in control of a collaborator or the assignment of a collaboration agreement to a third party, the successor entity or assignee, as in the case of MDCO and Novartis, could determine that it is in its interests to:

- pursue alternative technologies or develop alternative products, either on its own or jointly with others, that may be competitive with the products on which it is collaborating with us or which could affect its commitment to the collaboration with us;
- pursue higher-priority programs or change the focus of its development programs, which could affect the collaborator's commitment to us; or
- if it has marketing rights, choose to devote fewer resources to the marketing of our product candidates, if any are approved for marketing, than it does for product candidates developed without us.

If any of these occur, the development and commercialization of one or more products or product candidates could be delayed, curtailed or terminated because we may not have sufficient financial resources or capabilities to continue such development and commercialization on our own.

We have limited manufacturing experience and resources and we must incur significant costs to develop this expertise and/or rely on third parties to manufacture our products.

We have limited manufacturing experience. In order to continue to commercialize our approved products, continue to develop our current product candidates, apply for regulatory approvals and, if approved, commercialize future products, we will need to develop, contract for, or otherwise arrange for the necessary manufacturing capabilities. Historically, our internal manufacturing capabilities were limited to small-scale production of material for use in in vitro and in vivo experiments that is not required to be produced under GMP standards. During 2012, we developed cGMP capabilities and processes for the manufacture of patisiran formulated bulk drug product for late stage clinical trial use and commercial supply. In addition, during 2020, we completed construction and qualification of our cGMP manufacturing facility in Norton, Massachusetts where we manufacture drug substance for clinical and, eventually, will manufacture for commercial use. In December 2020, we began cGMP operations, and we believe this facility will enable us to initiate manufacturing for multiple new early-stage programs over the next few years, as well as provide us the manufacturing capabilities to support our late-stage and commercial programs in the future.

At the present time, we may manufacture limited quantities of clinical trial materials ourselves, but otherwise we continue to rely on third parties to manufacture the drug substance and finished product we will require for clinical trials that we initiate and to support the commercial supply of our approved products and any of our other product candidates. There are a limited number of manufacturers that supply synthetic siRNAs. We currently rely on a limited number of CMOs for our supply of synthetic siRNAs. There are risks inherent in pharmaceutical manufacturing that could affect the ability of our CMOs to meet our delivery time requirements or provide adequate amounts of material to meet our needs, and ultimately delay our clinical trials and potentially put at risk commercial supply, as well as result in additional expense to us. To fulfill our siRNA requirements, we will likely need to secure alternative suppliers of synthetic siRNAs and such alternative suppliers are limited and may not be readily available, or we may be unable to enter into agreements with them on reasonable terms and in a timely manner. As noted above, in order to ensure long-term supply capabilities for our RNAi therapeutics, we are developing our own capabilities to manufacture drug substance for clinical and commercial use.

In addition to the manufacture of the synthetic siRNAs, we may have additional manufacturing requirements related to the technology required to deliver the siRNA to the relevant cell or tissue type, such as LNPs or conjugates. In some cases, the delivery technology we utilize is highly specialized or proprietary, and for technical and/or legal reasons, we may have access to only one or a limited number of potential manufacturers for such delivery technology. In addition, the scale-up of our delivery technologies could be very difficult and/or take significant time. We also have very limited experience in such scale-up and manufacturing, requiring us to depend on a limited number of third parties, who might not be able to deliver in a timely manner, or at all. Failure by manufacturers to properly manufacture our delivery technology and/or formulate our siRNAs for delivery could result in unusable product, supply delays and shortages. Furthermore, competition for supply from our manufacturers from other companies, a breach by such manufacturers of their contractual obligations or a dispute with such manufacturers would cause delays in our discovery and development efforts, as well as additional expense to us. In response to the COVID-19 pandemic, in March 2020, the Coronavirus Aid, Relief, and Economic Security Act, or CARES Act, was enacted in March 2020, and requires that manufacturers have in place a risk management plan that identifies and evaluates the risks to the supply of approved drugs for certain serious diseases or conditions for each establishment where the drug or active pharmaceutical ingredient is manufactured. The risk management plan will be subject to FDA review during an inspection. If we experience shortages in the supply of our marketed products, as a result of COVID-19 or otherwise, our results could be materially impacted.

In developing manufacturing capabilities by building our own manufacturing facilities, we have incurred substantial expenditures, and expect to incur significant additional expenditures in the future. Also, we have had to, and will likely need to continue to, hire and train qualified employees to staff our facilities. If we are unable to manufacture sufficient quantities of

material or if we encounter problems with our facilities in the future, we may also need to secure alternative suppliers, and such alternative suppliers may not be available, or we may be unable to enter into agreements with them on reasonable terms and in a timely manner. Given our dependence on a limited number of CMOs to supply our commercial products and clinical candidates, and our dependence on our own facility, any delay in supply caused by the COVID-19 pandemic could impact our ability to procure sufficient supplies for our approved products, and the development of our product candidates could also be delayed. Any delay or setback in the manufacture of our approved products could impede ongoing commercial supply, which could significantly impact our revenues and operating results. In addition, to the extent we or our partners rely on CMOs outside of the U.S. to supply drug substance for our product candidates, any delays or disruptions in supply caused by the COVID-19 pandemic could have a material adverse impact on the research and development activities and potential commercialization of our or our partners' product candidates.

The manufacturing process for our approved products and any other products that we may develop, is subject to the FDA and foreign regulatory authority approval process and we will need to meet, and will need to contract with CMOs who can meet, all applicable FDA and foreign regulatory authority requirements on an ongoing basis. The failure of any CMO to meet required regulatory authority requirements could result in the delayed submission of regulatory applications, or delays in receiving regulatory approval for any of our or our current or future collaborators' product candidates. For example, in April 2022, due to an amendment to our existing regulatory submission to address a pending inspection classification at a third-party secondary packaging and labeling facility, the FDA extended the review timeline of the NDA for vutrisiran. In addition, if we receive the necessary regulatory approval for any product candidate, we also expect to rely on third parties, including potentially our commercial collaborators, to produce materials required for commercial supply.

To the extent that we have existing, or enter into future, manufacturing arrangements with third parties, we depend, and will depend in the future, on these third parties, to perform their obligations in a timely manner and consistent with contractual and regulatory requirements, including those related to quality control and quality assurance. The failure of any CMO to perform its obligations as expected, or, to the extent we manufacture all or a portion of our product candidates ourselves, our failure to execute on our manufacturing requirements, could adversely affect our business in a number of ways, including:

- we or our current or future collaborators may not be able to initiate or continue clinical trials of product candidates that are under development;
- we or our current or future collaborators may be delayed in submitting regulatory applications, or receiving regulatory approvals, for our product candidates;
- we may lose the cooperation of our collaborators;
- our facilities and those of our CMOs, and our products could be the subject of inspections by regulatory authorities that could have a negative outcome and result in delays in supply;
- we may be required to cease distribution or recall some or all batches of our products or take action to recover clinical trial material from clinical trial sites; and
- ultimately, we may not be able to meet commercial demands for our products.

We rely on third parties to conduct our clinical trials, and if they fail to fulfill their obligations, our development plans may be adversely affected.

We rely on independent clinical investigators, CROs, and other third-party service providers to assist us in managing, monitoring and otherwise carrying out our clinical trials. We have contracted, and we plan to continue to contract with, certain third parties to provide certain services, including site selection, enrollment, monitoring, auditing and data management services. These investigators and CROs are not our employees and we have limited control over the amount of time and resources they dedicate to our programs. These third parties may have contractual relationships with other entities, some of which may be our competitors, which may draw their time and resources away from our programs. Although we depend heavily on these parties, we control only certain aspects of their activity and therefore, we cannot be assured that these third parties will adequately perform all of their contractual obligations to us in compliance with regulatory and other legal requirements and our internal policies and procedures. Nevertheless, we are responsible for ensuring that each of our studies is conducted in accordance with the applicable protocol, legal, regulatory and scientific standards, and our reliance on third parties does not relieve us of our regulatory responsibilities. We and our CROs are required to comply with applicable GCP requirements, which are regulations and guidelines enforced by the FDA and comparable foreign regulatory authorities for all of our product candidates in clinical development, and to implement timely corrective action to any non-compliance. Regulatory authorities enforce these GCP requirements through periodic inspections of trial sponsors, principal investigators and trial sites, including in connection with the review of marketing applications. If we or any of our CROs fail to comply with applicable GCP requirements, or fail to take any such corrective action, the clinical data generated in our clinical trials may be deemed unreliable and the FDA, the EMA, the PMDA in Japan or comparable foreign regulatory authorities may require us to take additional action or perform additional clinical trials before approving our marketing applications. We cannot assure you that upon inspection by a given regulatory authority in the future, such regulatory authority will determine that any of our clinical trials comply with GCP regulations.

If our third-party service providers cannot adequately and timely fulfill their obligations to us for any reason, including due to disruptions caused by the COVID-19 pandemic or the ongoing conflict in Ukraine on their operations or at the sites they are overseeing, or if the quality and accuracy of our clinical trial data is compromised due to failure by such third party to adhere to our protocols or regulatory requirements or if such third parties otherwise fail to meet deadlines, our development plans and/or regulatory reviews for marketing approvals may be delayed or terminated. As a result, our stock price would likely be negatively impacted, and our results of operations and the commercial prospects for our product candidates would be harmed, our costs could increase and our ability to generate additional revenues could be delayed.

Risks Related to Managing Our Operations

If we are unable to attract and retain qualified key management and scientists, development, medical and commercial staff, consultants and advisors, our ability to implement our business plan may be adversely affected.

We are highly dependent upon our senior management and our scientific, clinical, sales and medical staff. The loss of the service of any of the members of our senior management could significantly delay or prevent the achievement of product development and commercialization, and other business objectives, and adversely impact our stock price. Our employment arrangements with our key personnel are terminable without notice. We do not carry key person life insurance on any of our employees.

We have grown our workforce significantly over the past several years and we face intense competition for qualified individuals from numerous pharmaceutical and biotechnology companies, universities, governmental entities and other research institutions, many of which have substantially greater resources with which to attract and reward qualified individuals than we do. In addition, if we are not successful commercializing our approved products, we may be unable to attract and retain highly qualified sales and marketing professionals to support our approved products and our future products, if approved. Accordingly, we may be unable to attract and retain suitably qualified individuals in order to support our growing research, development and global commercialization efforts and initiatives, and our failure to do so could have an adverse effect on our ability to implement our future business plans.

We may have difficulty expanding our operations successfully as we continue our evolution from a U.S.- and EU-based company primarily involved in discovery, pre-clinical testing and clinical development into a global company that develops and commercializes multiple drugs.

As we continue the commercial launches of our approved products, and increase the number of product candidates we are developing, we will need to continue to expand our operations in the U.S. and further develop operations in the EU and other geographies, including Asia and Latin America. To date, we have received regulatory approval for four products, which we have launched in multiple geographies globally, and we continue to expand the reach of these products with additional regulatory filings and launches.

We have grown our workforce significantly over the last several years and anticipate additional employee growth globally in the future as we focus on the commercialization of our approved products, and achieving our *Alnylam P^{5}x25* strategy. This growth has placed a strain on our administrative and operational infrastructure and, as a result, we will need to continue to develop additional and/or new infrastructure and capabilities to support our growth and obtain additional space to conduct our global operations in the U.S., the EU, Japan, Latin America and other geographies. If we are unable to develop such additional infrastructure or obtain sufficient space to accommodate our growth in a timely manner and on commercially reasonable terms, our business could be negatively impacted. As we continue the commercialization of our approved products, and as the product candidates we develop enter and advance through clinical trials, we will need to continue to expand our global development, regulatory, manufacturing, quality, compliance, and marketing and sales capabilities, or contract with other organizations to provide these capabilities for us. In addition, as our operations continue to expand, we will need to successfully manage additional relationships with various collaborators, suppliers, distributors and other organizations. Our ability to manage our operations and future growth will require us to continue to enhance our operational, financial and management controls and systems, reporting systems and infrastructure, ethics and compliance functions, and policies and procedures. We may not be able to implement enhancements to our management information and control systems in an efficient or timely manner and may discover deficiencies in existing systems and controls.

The use of social media presents risks and challenges.

Social media is being used to communicate about our clinical development programs and the diseases our investigational RNAi therapeutics are being developed to treat, and we are utilizing what we believe is appropriate social media in connection with our commercialization efforts for our approved products, and we intend to do the same for our future products, if approved. Social media practices in the biopharmaceutical industry continue to evolve and regulations and regulatory guidance relating to such use are evolving and not always clear. This evolution creates uncertainty and risk of noncompliance with regulations applicable to our business, resulting in potential regulatory actions against us, along with the potential for litigation related to off-label marketing or other prohibited activities. For example, for our clinical-stage candidates, patients may use social media channels to comment on their experience in an ongoing blinded clinical study or to report an alleged AE. When such disclosures occur, there is a risk that study enrollment may be adversely impacted, we fail to monitor and comply with

applicable AE reporting obligations or that we may not be able to defend our business or the public's legitimate interests in the face of the political and market pressures generated by social media due to restrictions on what we may say about our investigational products. There is also a risk of inappropriate disclosure of sensitive information or negative or inaccurate posts or comments about us on any online platform, including a blog on the internet, or a post on a website, that can be distributed rapidly and could negatively harm our reputation. If any of these events were to occur or we otherwise fail to comply with applicable regulations, we could incur liability, face regulatory actions or incur other harm to our business.

Our business and operations could suffer in the event of system failures or unauthorized or inappropriate use of or access to our systems.

We are increasingly dependent on our information technology systems and infrastructure for our business. We collect, store and transmit sensitive information including intellectual property, proprietary business information, including highly sensitive clinical trial data, and personal information in connection with business operations. The secure maintenance of this information is critical to our operations and business strategy. Some of this information could be an attractive target of criminal attack or unauthorized access and use by third parties with a wide range of motives and expertise, including organized criminal groups, "hacktivists," patient groups, disgruntled current or former employees and others. Cyber-attacks are of ever-increasing levels of sophistication, and despite our security measures, our information technology and infrastructure may be vulnerable to such attacks or may be breached, including due to employee error or malfeasance.

The pervasiveness of cybersecurity incidents in general and the risks of cyber-crime are complex and continue to evolve. Although we are making significant efforts to maintain the security and integrity of our information systems and are exploring various measures to manage the risk of a security breach or disruption, there can be no assurance that our security efforts and measures will be effective or that attempted security breaches or disruptions would not be successful or damaging. Despite the implementation of security measures, our internal computer systems and those of our contractors and consultants are vulnerable to damage or interruption from computer viruses, unauthorized or inappropriate access or use, natural disasters, pandemics (including COVID-19), terrorism, war (including the ongoing conflict in Ukraine), and telecommunication and electrical failures. Such events could cause interruption of our operations. For example, the loss of pre-clinical trial data or data from completed or ongoing clinical trials for our product candidates could result in delays in our regulatory filings and development efforts, as well as delays in the commercialization of our products, and significantly increase our costs. To the extent that any disruption, security breach or unauthorized or inappropriate use or access to our systems were to result in a loss of or damage to our data, or inappropriate disclosure of confidential or proprietary information, including but not limited to patient, employee or vendor information, we could incur notification obligations to affected individuals and government agencies, liability, including potential lawsuits from patients, collaborators, employees, stockholders or other third parties and liability under foreign, federal and state laws that protect the privacy and security of personal information, and the development and potential commercialization of our product candidates could be delayed.

Risks Related to Our Industry

Risks Related to Development, Clinical Testing and Regulatory Approval of Our Product Candidates and the Commercialization of Our Approved Products

Any product candidates we or our partners develop may fail in development or be delayed to a point where they do not become commercially viable.

Before obtaining regulatory approval for the commercial distribution of our product candidates, we must conduct, at our own expense, extensive nonclinical tests and clinical trials to demonstrate the safety and/or efficacy in humans of our product candidates. Nonclinical and clinical testing is expensive, difficult to design and implement, can take many years to complete and is uncertain as to outcome, and the historical failure rate for product candidates is high. We currently have multiple programs in clinical development, including internal and partnered programs in Phase 3 development, as well as several earlier-stage clinical programs. However, we may not be able to further advance any of our product candidates through clinical trials and regulatory approval.

Additionally, several of our planned and ongoing clinical trials utilize an "open-label" trial design. An "open-label" clinical trial is one where both the patient and investigator know whether the patient is receiving the investigational product candidate or either an existing approved drug or placebo. Most typically, open-label clinical trials test only the investigational product candidate and sometimes may do so at different dose levels. Open-label clinical trials are subject to various limitations that may exaggerate any therapeutic effect as patients in open-label clinical trials are aware when they are receiving treatment. Open-label clinical trials may be subject to a "patient bias" where patients perceive their symptoms to have improved merely due to their awareness of receiving an experimental treatment. In addition, open-label clinical trials may be subject to an "investigator bias" where those assessing and reviewing the physiological outcomes of the clinical trials are aware of which patients have received treatment and may interpret the information of the treated group more favorably given this knowledge. The results from an open-label trial may not be predictive of future clinical trial results with any of our product candidates for which we include an open-label clinical trial when studied in a controlled environment with a placebo or active control.

If we enter into clinical trials, the results from nonclinical testing or early or late stage clinical trials of a product candidate may not predict the results that will be obtained in subsequent subjects or in subsequent human clinical trials of that product candidate or any other product candidate. For example, we are conducting the APOLLO-B and HELIOS-B Phase 3 clinical trials of patisiran and vutrisiran, respectively, which are investigating the potential of patisiran and vutrisiran to treat the cardiac manifestations of disease in patients with ATTR amyloidosis with cardiomyopathy. We announced positive topline results from the APOLLO-B study in August 2022, and patients enrolled in the study are receiving patisiran as part of an open-label extension period. While both patisiran and vutrisiran have demonstrated positive results in patients with hATTR amyloidosis with polyneuropathy, we cannot be certain that the results from HELIOS-B will be positive or that the results from APOLLO-B and/or HELIOS-B will support approval of patisiran and/or vutrisiran for the treatment of patients with ATTR amyloidosis with cardiomyopathy. There is a high failure rate for drugs proceeding through clinical studies. A number of companies in the pharmaceutical and biotechnology industries have suffered significant setbacks in clinical development even after achieving promising results in earlier studies, and any such setbacks in our clinical development, including with respect to patisiran and/or vutrisiran, could have a material adverse effect on our business and operating results. Moreover, our approved products and our current product candidates, employ novel delivery technologies that, with the exception of inclisiran, have yet to be extensively evaluated in human clinical trials and proven safe and effective.

In addition, we, the FDA or other applicable regulatory authorities, or an IRB, or similar foreign review board or committee, may delay initiation of or suspend clinical trials of a product candidate at any time for various reasons, including if we or they believe the healthy volunteer subjects or patients participating in such trials are being exposed to unacceptable health risks. Among other reasons, adverse side effects of a product candidate or related product on healthy volunteer subjects or patients in a clinical trial could result in our decision, or a decision by the FDA or foreign regulatory authorities, to suspend or terminate the trial, or, in the case of regulatory agencies, a refusal to approve a particular product candidate for any or all indications of use. For example, in October 2016, we announced our decision to discontinue development of revusiran, an investigational RNAi therapeutic that was being developed for the treatment of patients with cardiomyopathy due to hATTR amyloidosis. Our decision followed the recommendation of the revusiran ENDEAVOUR Phase 3 study Data Monitoring Committee to suspend dosing and the observation of an imbalance in mortality in revusiran-treated patients as compared to those on placebo.

Clinical trials of a new product candidate require the enrollment of a sufficient number of patients, including patients who are suffering from the disease the product candidate is intended to treat and who meet other eligibility criteria. Rates of patient enrollment are affected by many factors, including the size of the patient population, the age and condition of the patients, the stage and severity of disease, the availability of clinical trials for other investigational drugs for the same disease or condition, the nature of the protocol, the proximity of patients to clinical sites, the availability of effective treatments for the relevant disease, and the eligibility criteria for the clinical trial. For example, we or our partners may experience difficulty enrolling our clinical trials, including, but not limited to, the ongoing clinical trials for fitusiran, due to the availability of existing approved treatments, as well as other investigational treatments in development. In addition, in November 2018 we announced that due to recruitment challenges, we had discontinued a Phase 2 study of cemdisiran in atypical hemolytic uremic syndrome and are focusing our cemdisiran clinical development efforts in a different indication. Delays or difficulties in patient enrollment, including the enrollment delays in our KARDIA-1 Phase 2 monotherapy study of zilebesiran resulting from the ongoing situation in Ukraine, or difficulties retaining trial participants, including as a result of the availability of existing or other investigational treatments or safety concerns, including the impact of public health emergencies such as the COVID-19 pandemic, can result in increased costs, longer development times or termination of a clinical trial.

Although our investigational RNAi therapeutics have been generally well-tolerated in our clinical trials to date, new safety findings may emerge. For example, in September 2017, we announced that we had temporarily suspended dosing in all ongoing fitusiran studies pending further review of a fatal thrombotic SAE that occurred in a patient with hemophilia A without inhibitors who was receiving fitusiran in our Phase 2 OLE study. More recently, in October 2020, Sanofi voluntarily paused dosing in all ongoing fitusiran clinical studies to assess reports of non-fatal thrombotic events in patients participating in the ATLAS Phase 3 program. Following an assessment of available data and alignment with regulators, patients restarted on fitusiran under amended protocols in ongoing clinical studies. In October 2021, Sanofi announced that a potential filing date for fitusiran has been moved to 2024 due to the introduction of a revised dosing regimen in the ongoing phase 3 studies.

As demonstrated by the discontinuation of our revusiran program in October 2016, the temporary suspension of dosing in September 2017 in our fitusiran studies, as well as Sanofi's voluntary pause of fitusiran studies in October 2020, the occurrence of SAEs and/or AEs can result in the suspension or termination of clinical trials of a product candidate by us, our partners, or the FDA or a foreign regulatory authority. The occurrence of SAEs and/or AEs could also result in refusal by the FDA or a foreign regulatory authority to approve a particular product candidate for any or all indications of use.

Clinical trials also require the review, oversight and approval of IRBs, or, outside of the U.S., an independent ethics committee, which continually review clinical investigations and protect the rights and welfare of human subjects. Inability to obtain or delay in obtaining IRB or ethics committee approval can prevent or delay the initiation and completion of clinical trials, and the FDA or foreign regulatory authorities may decide not to consider any data or information derived from a clinical investigation not subject to initial and continuing IRB or ethics committee review and approval, as the case may be, in support of a marketing application.

Our product candidates that we develop may encounter problems during clinical trials that will cause us, an IRB, ethics committee or regulatory authorities to delay, suspend or terminate these trials, or that will delay or confound the analysis of data from these trials. If we experience any such problems, we may not have the financial resources to continue development of the product candidate that is affected, or development of any of our other product candidates. We may also lose, or be unable to enter into, collaborative arrangements for the affected product candidate and for other product candidates we are developing.

A failure of one or more of our clinical trials can occur at any stage of testing. We may experience numerous unforeseen events during, or as a result of, nonclinical testing and the clinical trial process that could delay or prevent regulatory approval or our ability to commercialize our product candidates, including:

- our nonclinical tests or clinical trials may produce negative or inconclusive results, and we may decide, or regulators may require us, to conduct additional nonclinical testing or clinical trials, or we may abandon projects that we expect to be promising;
- delays in filing IND applications or comparable foreign applications or delays or failure in obtaining the necessary approvals from regulators or IRBs/ethics committees in order to commence a clinical trial at a prospective trial site, or their suspension or termination of a clinical trial once commenced;
- conditions imposed on us by an IRB or ethics committee, or the FDA or comparable foreign authorities regarding the scope or design of our clinical trials;
- problems in engaging IRBs or ethics committees to oversee clinical trials or problems in obtaining or maintaining IRB or ethics committee approval of trials;
- delays in enrolling patients and volunteers into clinical trials, and variability in the number and types of patients and volunteers available for clinical trials, including as a result of the COVID-19 pandemic and the ongoing conflict in Ukraine;
- disruptions caused by man-made or natural disasters or public health pandemics or epidemics or other business interruptions, including the ongoing COVID-19 pandemic;
- high drop-out rates for patients and volunteers in clinical trials;
- negative or inconclusive results from our clinical trials or the clinical trials of others for product candidates similar to ours;
- inadequate supply or quality of product candidate materials or other materials necessary for the conduct of our clinical trials or disruption or delays in the clinical supply due to the COVID-19 or a future pandemic;
- greater than anticipated clinical trial costs;
- serious and unexpected drug-related side effects experienced by participants in our clinical trials or by individuals using drugs similar to our product candidates;
- poor or disappointing effectiveness of our product candidates during clinical trials;
- unfavorable FDA or other regulatory agency inspection and review of a clinical trial site or records of any clinical or nonclinical investigation;
- failure of our third-party contractors or investigators to comply with regulatory requirements, including GCP and cGMP, or otherwise meet their contractual obligations in a timely manner, or at all;
- governmental or regulatory delays and changes in regulatory requirements, policy and guidelines, including the imposition of additional regulatory oversight around clinical testing generally or with respect to our technology in particular; or
- interpretations of data by the FDA and similar foreign regulatory agencies that differ from ours.

Even if we successfully complete clinical trials of our product candidates, any given product candidate may not prove to be a safe and effective treatment for the disease for which it was being tested.

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

Our and our partnered product candidates are subject to extensive governmental regulations relating to, among other things, research, testing, development, manufacturing, safety, efficacy, approval, recordkeeping, reporting, labeling, storage, pricing, marketing and distribution of drugs. Rigorous nonclinical testing and clinical trials and an extensive regulatory approval process are required to be successfully completed in the U.S. and in many foreign jurisdictions before a new drug can be marketed. Satisfaction of these and other regulatory requirements is costly, time consuming, uncertain and subject to unanticipated delays. It is possible that the product candidates we and our partners are developing will not obtain the regulatory approvals necessary for us or our collaborators to begin selling them, or, in the case of patisiran and vutrisiran, will not obtain

regulatory approval to be sold for broader indications than are currently approved. It is also possible that the FDA or other regulatory authorities may determine that the data generated in clinical trials for a product candidate, including patisiran, while positive, is not sufficient to support the approval of an application for regulatory approval. In February 2023, the FDA accepted our sNDA for ONPATTRO for filing and set an action date of October 8, 2023, under the PDUFA. The FDA also indicated in the sNDA filing communication letter that it is planning to hold an advisory committee meeting to discuss the application and that it had not identified any potential review issues at such time. Even though the sNDA has been accepted for filing, we may receive a complete response letter rather than approval, including for reasons that may be identified during a meeting of the advisory committee.

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

Because the drugs we or our partners are developing represent a new class of drug, the FDA and its foreign counterparts have not yet established any definitive policies, practices or guidelines in relation to these drugs. The lack of policies, practices or guidelines may hinder or slow review by the FDA of any regulatory filings that we or our partners may submit. Moreover, the FDA may respond to these submissions by defining requirements we or our partners may not have anticipated. Such responses could lead to significant delays and increased costs in the development of our or our partnered product candidates. In addition, because there may be approved treatments for some of the diseases for which we or our partners may seek approval, including patisiran and vutrisiran for the treatment of ATTR amyloidosis with cardiomyopathy, or treatments in development which are approved by the time we or they apply for approval, in order to receive regulatory approval, we or they may need to demonstrate through clinical trials that the product candidates we develop to treat these diseases, if any, are not only safe and effective, but safer or more effective than existing products. Interruption or delays in the operations of the FDA, EMA and comparable foreign regulatory agencies due to the COVID-19 pandemic, may impact the review, inspection and approval timelines for our or our partnered product candidates. During the COVID-19 public health emergency, the FDA has worked to ensure timely reviews of applications for medical products in line with its user fee performance goals and conduct mission critical domestic and foreign inspections to ensure compliance of manufacturing facilities with FDA quality standards. However, the FDA may not be able to continue its current pace and approval timelines could be extended, including where a pre-approval inspection or an inspection of clinical sites is required and due to the ongoing COVID-19 pandemic and travel restrictions the FDA is unable to complete such required inspections during the review period. During the COVID-19 public health emergency, a number of companies announced receipt of complete response letters due to the FDA's inability to complete required inspections for their applications. In December 2020, the FDA issued a complete response letter regarding Novartis' NDA for inclisiran, stating that the agency could not approve the NDA by the PDUFA action date due to unresolved facility inspection-related conditions. In July 2021, Novartis announced that the resubmission to the FDA of the inclisiran NDA to address the complete response letter was filed, and the FDA approved Leqvio (which is the trade name under which inclisiran is marketed in the U.S.) in December 2021. The delay in the approval of Leqvio resulted in delayed milestone and royalty revenue to us. Any similar interruption or delay by the FDA, EMA or comparable foreign regulatory agency could have a material adverse effect on our efforts to obtain regulatory approval for our product candidates, which could have a material adverse effect on our financial results. For instance, the FDA may request additional clinical or other data or information in connection with the regulatory review of our or our partners' product candidates, including patisiran, including by issuing a complete response letter which may require that we or our partners' submit additional clinical or other data or impose other conditions that must be met in order to secure final approval of our or our partners' NDA applications, including potentially requiring a facility inspection. Even if such data and information are submitted, or any such inspection is completed, the FDA may ultimately decide that the NDA does not satisfy the criteria for approval.

Any delay or failure in obtaining required approvals for our product candidates or our partnered product candidates could have a material adverse effect on our ability to generate revenues from any product candidate for which we or our partners may seek approval in the future. Furthermore, any regulatory approval to market any product, including patisiran, may be subject to limitations on the approved uses for which we or our partners may market the product or the labeling or other restrictions, which could limit each such product's market opportunity and have a negative impact on our results of operations and our stock price. In addition, the FDA has the authority to require a Risk Evaluation and Mitigation Strategy, or REMS, plan as part of an NDA, or after approval, which may impose further requirements or restrictions on the distribution or use of an approved drug, such as limiting prescribing to certain physicians or medical centers that have undergone specialized training, limiting treatment to patients who meet certain safe-use criteria and requiring treated patients to enroll in a registry. In the EU, we or our partners could be required to adopt a similar plan, known as a risk management plan, and our products could be subject to specific risk minimization measures, such as restrictions on prescription and supply, the conduct of post-marketing safety or efficacy studies,

or the distribution of patient and/or prescriber educational materials. In either instance, these limitations and restrictions may limit the size of the market for the product and affect reimbursement by third-party payors.

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

Even if we or our partners obtain regulatory approvals, our marketed drugs will be subject to ongoing regulatory oversight. If we or our partners fail to comply with continuing U.S. and foreign requirements, our approvals could be limited or withdrawn, we could be subject to other penalties, and our business would be seriously harmed.

Following any initial regulatory approval of drugs we or our partners may develop, including our four approved drugs, we will also be subject to continuing regulatory oversight, including the review of adverse drug experiences and clinical results that are reported after our drug products are made commercially available. This would include results from any post-marketing tests or surveillance to monitor the safety and efficacy of our approved drugs or other drug products required as a condition of approval or agreed to by us. The regulatory approvals that we receive for ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO, as well as any regulatory approvals we receive for any other product candidates may also be subject to limitations on the approved uses for which the product may be marketed, including any expanded label for ONPATTRO or AMVUTTRA. Other ongoing regulatory requirements include, among other things, submissions of safety and other post-marketing information and reports, registration and listing, as well as continued compliance with good practice quality guidelines and regulations, including cGMP requirements and GCP requirements for any clinical trials that we conduct post-approval. In addition, we are conducting, and intend to continue to conduct, clinical trials for our product candidates, and we intend to seek approval to market our product candidates, in jurisdictions outside of the U.S., and therefore will be subject to, and must comply with, regulatory requirements in those jurisdictions.

The FDA has significant post-market authority, including, for example, the authority to require labeling changes based on new safety information and to require post-market studies or clinical trials to evaluate serious safety risks related to the use of a drug and to require withdrawal of the product from the market. The FDA also has the authority to require a REMS plan after approval, which may impose further requirements or restrictions on the distribution or use of an approved drug. As our approved products are used commercially, we or others could identify previously unknown side effects or known side effects could be observed as being more frequent or severe than in clinical studies or earlier post-marketing periods, in which case:

- sales of our approved products may be more modest than originally anticipated;
- regulatory approvals for our approved products may be restricted or withdrawn;
- we may decide, or be required, to send product warning letters or field alerts to physicians, pharmacists and hospitals;
- additional nonclinical or clinical studies, changes in labeling, adoption of a REMS plan, or changes to manufacturing processes, specifications and/or facilities may be required; and
- government investigations or lawsuits, including class action suits, may be brought against us.

Any of the above occurrences could reduce or prevent sales of our approved products, increase our expenses and impair our ability to successfully commercialize one or more of these products.

The CMO and manufacturing facilities we use to make our approved products and certain of our current product candidates, including our Cambridge facility, our Norton facility, as well as facilities at Agilent and other CMOs, will also be subject to periodic review and inspection by the FDA and other regulatory agencies. For example, Agilent and our Cambridge-based facility were subject to regulatory inspection by the FDA and the EMA in connection with the review of our applications for regulatory approval for ONPATTRO and GIVLAARI, and may be subject to similar inspection in connection with any subsequent applications for regulatory approval of one or more of our products filed in other territories. The discovery of any new or previously unknown problems with our facilities or our CMOs, or our or their manufacturing processes or facilities, may result in restrictions on the drug or CMO or facility, including delay in approval or, in the future, withdrawal of the drug from the market. For example, due to a routine inspection by the FDA at a CMO facility that resulted in a pending inspection classification, we amended our regulatory submission for vutrisiran, which delayed our PDUFA goal date and AMVUTTRA's FDA approval. We have developed cGMP capabilities and processes for the manufacture of patisiran formulated bulk drug product for commercial use. In addition, in 2020, we completed construction of a cGMP manufacturing facility for drug substance for clinical and, eventually, commercial use. We may not have the ability or capacity to manufacture material at a broader commercial scale in the future. We may manufacture clinical trial materials, or we may contract a third party to manufacture this material for us. Reliance on CMOs entails risks to which we would not be subject if we manufactured products ourselves, including reliance on the CMO for regulatory compliance.

If we or our collaborators, CMOs or service providers fail to comply with applicable continuing regulatory requirements in the U.S. or foreign jurisdictions in which we may seek to market our products, we or they may be subject to, among other

things, fines, warning letters, holds on clinical trials, refusal by the FDA or foreign regulatory authorities to approve pending applications or supplements to approved applications, suspension or withdrawal of regulatory approval, product recalls and seizures, refusal to permit the import or export of products, operating restrictions, injunction, civil penalties and criminal prosecution.

We may incur significant liability if enforcement authorities allege or determine that we are engaging in commercial activities or promoting our commercially approved products in a way that violates applicable regulations.

Physicians have the discretion to prescribe approved drug products for uses that are not described in the product's labeling and that differ from those approved by the FDA or other applicable regulatory agencies. Off-label uses are common across medical specialties. Although the FDA and other regulatory agencies that approve drug products do not regulate a physician's practice of medicine or choice of treatments, the FDA and other regulatory agencies regulate a manufacturer's communications regarding off-label use and prohibit off-label promotion, as well as the dissemination of false or misleading labeling or promotional materials, including by their agents. Manufacturers and their agents may not promote drugs for off-label uses or provide off-label information in the promotion of drug products that is not consistent with the approved labeling for those products. For example, we may not promote ONPATTRO or AMVUTTRA in the U.S. for use in any indications other than the treatment of the polyneuropathy of hATTR amyloidosis in adults. The FDA and other regulatory and enforcement authorities actively enforce laws and regulations prohibiting promotion of off-label uses and the promotion of products for which marketing approval has not been obtained. In April 2021, we received a subpoena from the U.S. Department of Justice, U.S. Attorney's Office for the District of Massachusetts, requiring production of documents pertaining to our marketing and promotion of ONPATTRO (patisiran) in the U.S. We are cooperating with the U.S. Attorney's Office and producing documents in response to the subpoena. Current and former officers and employees also have received subpoenas in connection with the preservation and production of related materials. Given the ongoing nature of the investigation, it is possible that the U.S. Attorney's Office for the District of Massachusetts or other government entities may request other information from, or issue other subpoenas, findings or similar documents to, us, our related entities and their respective directors, officers and employees. If we are found to have improperly marketed or promoted ONPATTRO in connection with such subpoenas, we may be subject to a broad range of civil, administrative and criminal penalties, including injunctive relief related to ONPATTRO promotional activities, substantial fines or penalties, and other legal or equitable sanctions. Any adverse decision, finding, allegation, or exercise of enforcement or regulatory discretion could harm our business, prospects, operating results, and financial condition. Other internal or government investigations or legal or regulatory proceedings, including lawsuits brought by private litigants, may also follow as a consequence.

Notwithstanding regulations related to product promotion, the FDA and other regulatory authorities allow companies to engage in truthful, non-misleading and non-promotional scientific exchange concerning their products, and we intend to engage in medical education activities and communicate with healthcare providers in compliance with all applicable laws and regulatory guidance. Nonetheless, the FDA, other applicable regulatory authorities, competitors, and other third parties may take the position that we are not in compliance with such regulations, and if such non-compliance is proven, it could harm our reputation, financial condition or divert financial and management resources from our core business, and would have a material adverse effect on our business, financial condition and results of operations. Moreover, any threatened or actual government enforcement actions or lawsuits by third parties could also generate adverse publicity, which could decrease demand for our products and require that we devote substantial resources that could be used productively on other aspects of our business.

In addition to our medical education efforts, we also offer patient support services to assist patients receiving treatment with our commercially approved products. Manufacturers have increasingly become the focus of government investigation of patient support programs based on allegations that through such services illegal inducements are provided to physicians and/or patients, leading to improper utilization of government resources through Medicare, Medicaid and other government programs. Companies that are found to have violated laws such as the federal Anti-Kickback Statute and/or FCA face significant liability, including civil and administrative penalties, criminal sanctions, and potential exclusion from participation in government programs.

As described above, we remain focused on our global compliance program, which is designed to support the execution of these programs and activities in compliance with applicable laws.

Even if we receive regulatory approval to market our product candidates, the market may not be receptive to our product candidates upon their commercial introduction, which could prevent us from becoming profitable.

The product candidates that we are developing are based upon new technologies or therapeutic approaches. Key participants in pharmaceutical marketplaces, such as physicians, third-party payors and consumers, may not accept a product intended to improve therapeutic results based on RNAi technology. As a result, it may be more difficult for us to convince the medical community and third-party payors to accept and use our product, or to provide favorable reimbursement.

Other factors that we believe will materially affect market acceptance of our product candidates include:

- the timing of our receipt of any marketing approvals, the terms of any approvals and the countries in which approvals are obtained;

- the safety and efficacy of our product candidates, as demonstrated in clinical trials and as compared with alternative treatments, if any;
- relative convenience and ease of administration of our product candidates;
- the willingness of patients to accept potentially new routes of administration or new or different therapeutic approaches and mechanisms of action;
- the success of our physician education programs;
- the availability of adequate government and third-party payor reimbursement;
- the pricing of our products, particularly as compared to alternative treatments, and the market perception of such prices and any price increase that we may implement in the future; and
- availability of alternative effective treatments for the diseases that product candidates we develop are intended to treat and the relative risks, benefits and costs of those treatments.

For example, one of our two commercially approved therapeutics for the treatment of the polyneuropathy of hATTR amyloidosis in adults, ONPATTRO, utilizes an intravenous mode of administration with pre-medication that physicians and/or patients may not readily adopt, or which may not compete favorably with other available options, including inotersen, marketed by Ionis in several countries, which is administered subcutaneously, or tafamidis, marketed by Pfizer in several countries, which is in pill form. In addition, fitusiran represents a new approach to treating hemophilia which may not be readily accepted by patients and their caregivers. Patisiran, if approved for the treatment of ATTR amyloidosis with cardiomyopathy, could face similar challenges in market acceptance.

We are a multi-product commercial company and expect to continue to invest significant financial and management resources to continue to build our marketing, sales, market access and distribution capabilities and further establish our global infrastructure. Even if we successfully scale our commercial capabilities, the market may not be receptive to our commercial products.

Having received our first product approval in August 2018, we have established our capabilities for marketing, sales, market access and distribution over the last several years. We currently expect to rely on third parties to launch and market certain of our product candidates in certain geographies, if approved. However, we are commercializing ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO, and intend to commercialize several of our late-stage product candidates, if approved, on our own globally in major markets. Accordingly, we have developed internal marketing, sales, market access and distribution capabilities as part of our core product strategy initially in the U.S., Europe and Japan, with expansion ongoing globally, which has, and will continue to, require significant financial and management resources. For those products for which we will perform marketing, sales, market access and distribution functions ourselves, including ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO, and for future products we successfully develop where we may retain certain product development and commercialization rights, we could face a number of additional risks, including:

- scaling and retaining our global sales, marketing and administrative infrastructure and capabilities;
- hiring, training, managing and supervising our personnel worldwide;
- the cost of further developing, or leveraging an established, marketing or sales force, which may not be justifiable in light of the revenues generated by any particular product and/or in any specific geographic region; and
- our direct sales and marketing efforts may not be successful.

If we are unable to continue to develop and scale our own global marketing, sales, market access and distribution capabilities for our current and any future products, we will not be able to successfully commercialize our products without reliance on third parties.

The patient populations suffering from hATTR amyloidosis, AHP and PH1 are small and have not been established with precision. If the actual number of patients is smaller than we estimate, or if we cannot raise awareness of these diseases and diagnosis is not improved, our revenue and ability to achieve profitability from these products may be adversely affected.

Our estimates regarding the potential market size for ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO or any future products at the time we commence commercialization, may be materially different from the actual market size, including as a result of the indication approved by regulatory authorities, which could result in significant changes in our business plan and may have a material adverse effect on our results of operations and financial condition. For example, the initial indication approved by the FDA for ONPATTRO is for the treatment of the polyneuropathy of hATTR amyloidosis and not for the treatment of cardiomyopathy or other manifestations of the disease. In addition, the U.S. label does not include cardiac data included in our APOLLO-B Phase 3 study results. This had an adverse impact on the market opportunity for ONPATTRO in the U.S. While data from the APOLLO-B study of patisiran in ATTR amyloidosis patients with cardiomyopathy was positive, the FDA may determine that the data is not supportive of a label expansion of ONPATTRO for the treatment of cardiomyopathy, which would further impact ONPATTRO's market opportunity. In addition, our efforts to raise disease

awareness and improve diagnosis of our relevant disease states have been and may in the future be impacted by the COVID-19 pandemic. For example, in 2020 and 2021, we saw a reduction in peer to peer educational opportunities, reduced physician attendance at congresses and symposia and overall opportunities for physician engagement. As is the case with most orphan diseases, if we cannot successfully raise awareness of these diseases and improve diagnosis, it will be more difficult or impossible to achieve profitability.

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

The regulations that govern marketing approvals, pricing and reimbursement for new drugs vary widely from country to country. Some countries require approval of the sale price of a drug before it can be marketed. In many countries, the pricing review period begins after marketing or product licensing approval is granted. In some foreign markets, prescription pharmaceutical pricing remains subject to continuing governmental control even after initial approval is granted. We are actively monitoring these regulations as we market and sell our approved products and as several of our other programs move through late stages of development. However, a number of our programs are currently in the earlier stages of development, and we will not be able to assess the impact of price regulations for such programs for a number of years. We might obtain regulatory approval for a product, including one or more of our approved products, in a particular country, but then be subject to price regulations that delay our commercial launch of the product and negatively impact the revenues we are able to generate from the sale of the product in that country and potentially in other countries due to reference pricing.

Our ability to commercialize our approved products or any future products successfully also will depend in part on the extent to which reimbursement for these products and related treatments will be available from government health administration authorities, private health insurers and other organizations. One or more of our approved products and other products for which we are able to obtain marketing approval may not be considered cost-effective, and the amount reimbursed may be insufficient to allow us to sell such product(s) or any future products on a competitive basis. Increasingly, the third-party payors who reimburse patients or healthcare providers, such as government and private insurance plans, are requiring that drug companies provide them with predetermined discounts from list prices, and are seeking to reduce the prices charged or the amounts reimbursed for drug products. In the U.S., we have entered into over 40 value-based agreements, or VBAs, and are negotiating additional VBAs with commercial health insurers. The goal of these agreements is to ensure that we are paid based on the ability of our commercially approved products to deliver results in the real world setting comparable to those demonstrated in clinical trials, and the agreements are structured to link the performance of our approved products in real-world use to financial terms. Partnering with payers on these agreements is also intended to provide more certainty to them for their investment and help accelerate coverage decisions for patients. If the payment we receive for our products, or the reimbursement provided for such products, is inadequate in light of our development and other costs, or if reimbursement is denied, our return on investment could be adversely affected. In addition, we have stated publicly that we intend to grow through continued scientific innovation rather than arbitrary price increases. Specifically, we have stated that we will not raise the price of any product for which we receive marketing approval over the rate of inflation, as determined by the consumer price index for urban consumers (approximately 6.4% currently) absent a significant value driver. Our patient access philosophy could also negatively impact the revenues we are able to generate from the sale of one or more of our products in the future.

Some of the drugs we market need to be administered under the supervision of a physician or other healthcare professional on an outpatient basis, including ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO. Under currently applicable U.S. law, certain drugs that are not usually self-administered (including injectable drugs) may be eligible for coverage under the Medicare Part B program if:

- they are incident to a physician's services;
- they are reasonable and necessary for the diagnosis or treatment of the illness or injury for which they are administered according to accepted standards of medical practice; and
- they have been approved by the FDA and meet other requirements of the statute.

There may be significant delays in obtaining coverage for newly approved drugs, and coverage may be more limited than the purposes for which the drug is approved by the FDA or foreign regulatory authorities. Moreover, eligibility for coverage does not imply that any drug will be reimbursed in all cases or at a rate that covers our costs, including research, development, manufacture, sale and distribution or that covers a particular provider's cost of acquiring the drug. Interim payments for new drugs, if applicable, may also not be sufficient to cover our costs and may not be made permanent. Reimbursement may be based on payments allowed for lower-cost drugs that are already reimbursed, may be incorporated into existing payments for other services and may reflect budgetary constraints or imperfections in Medicare data. Net prices for drugs may be reduced by mandatory discounts or rebates required by government healthcare programs or private payors and by any future relaxation of laws that presently restrict imports of drugs from countries where they may be sold at lower prices than in the U.S.

President Biden signed an Executive Order on July 9, 2021 affirming the administration's policy to (i) support legislative reforms that would lower the prices of prescription drugs, including by allowing Medicare to negotiate drug prices, by imposing

inflation caps, and, by supporting the development and market entry of lower-cost generic drugs and biosimilars; and (ii) support the enactment of a public health insurance option. Among other things, the Executive Order also directs the U.S. Department of Health and Human Services, or HHS, to provide a report on actions to combat excessive pricing of prescription drugs, continue to clarify and improve the approval framework for generic drugs and identify and address any efforts to impede generic drug competition, enhance the domestic drug supply chain, reduce the price that the Federal government pays for drugs, and address price gouging in the industry; and directs the FDA to work with states and Indian Tribes that propose to develop section 804 Importation Programs in accordance with the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, and the FDA's implementing regulations. The FDA released such implementing regulations on September 24, 2020, which went into effect on November 30, 2020, providing guidance for states to build and submit importation plans for drugs from Canada. In response, authorities in Canada have passed rules designed to safeguard the Canadian drug supply from shortages. If implemented, importation of drugs from Canada and the Most Favored Nation, or MFN, Model may materially and adversely affect the price we receive for any of our commercially approved products. Further, on November 20, 2020, CMS issued an Interim Final Rule implementing the MFN Model under which Medicare Part B reimbursement rates will be calculated for certain drugs based on the lowest price drug manufacturers receive in OECD countries with a similar gross domestic product per capita. The MFN Model regulations mandate participation by identified Part B providers and would have applied to all U.S. states and territories for a seven-year period beginning January 1, 2021, and ending December 31, 2027. However, on December 29, 2021, CMS rescinded the proposed MFN rule. Additionally, on December 2, 2020, HHS published a regulation removing safe harbor protection for price reductions from pharmaceutical manufacturers to plan sponsors under Part D, either directly or through pharmacy benefit managers, unless the price reduction is required by law. The rule also creates a new safe harbor for price reductions reflected at the point-of-sale, as well as a safe harbor for certain fixed fee arrangements between pharmacy benefit managers and manufacturers. Pursuant to court order, the removal and addition of the aforementioned safe harbors have been delayed until January 1, 2023, requiring manufacturers to ensure the full value of co-pay assistance is passed on to the patient or these dollars will count toward the Average Manufacturer Price and Best Price calculation of the drug. On May 17, 2022, the U.S. District Court for the District of Columbia granted the Pharmaceutical Research and Manufacturers of America's motion for summary judgement invalidating the accumulator adjustment rule. Although a number of these and other proposed measures may require authorization through additional legislation to become effective, and the current U.S. presidential administration may reverse or otherwise change these measures, both the current U.S. presidential administration and Congress have indicated that they will continue to seek new legislative measures to control drug costs.

We believe that the efforts of governments and third-party payors to contain or reduce the cost of healthcare and legislative and regulatory proposals to broaden the availability of healthcare will continue to affect the business and financial condition of pharmaceutical and biopharmaceutical companies. Specifically, there have been several recent U.S. Congressional inquiries and proposed federal and state legislation designed to, among other things, bring more transparency to drug pricing, reduce the cost of prescription drugs under Medicare, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drugs.

A number of other legislative and regulatory changes in the healthcare system in the U.S. and other major healthcare markets have been proposed or enacted in recent months and years, and such efforts have expanded substantially in recent years. These developments could, directly or indirectly, affect our ability to sell ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO or future products, if approved, at a favorable price.

In particular, in March 2010, the ACA was signed into law. This legislation changed the system of healthcare insurance and benefits intended to broaden coverage and control costs. The law also contains provisions that affect companies in the pharmaceutical industry and other healthcare related industries by imposing additional costs and changes to business practices. Among the provisions affecting pharmaceutical companies are the following:

- Mandatory rebates for drugs sold into the Medicaid program were increased, and the rebate requirement was extended to drugs used in risk-based Medicaid managed care plans.
- The 340B Drug Pricing Program under the Public Health Service Act was extended to require mandatory discounts for drug products sold to certain critical access hospitals, cancer hospitals and other covered entities.
- Pharmaceutical companies are required to offer discounts on brand-name drugs to patients who fall within the Medicare Part D coverage gap, commonly referred to as the "donut hole."
- Pharmaceutical companies are required to pay an annual non-tax deductible fee to the federal government based on each company's market share of prior year total sales of branded products to certain federal healthcare programs, such as Medicare, Medicaid, Department of Veterans Affairs and Department of Defense. Since we expect our branded pharmaceutical sales to constitute a small portion of the total federal healthcare program pharmaceutical market, we do not expect this annual assessment to have a material impact on our financial condition.
- The law provides that approval of an application for a follow-on biologic product may not become effective until 12 years after the date on which the reference innovator biologic product was first licensed by the FDA, with a possible

six-month extension for pediatric products. After this exclusivity ends, it will be easier for generic manufacturers to enter the market, which is likely to reduce the pricing for such products and could affect our profitability.

- The law creates 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.
- The law expands 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.
- The law expands the entities eligible for discounts under the Public Health Service Act pharmaceutical pricing program.
- The law expands healthcare fraud and abuse laws, including the civil FCA and the federal Anti-Kickback Statute, new government investigative powers, and enhanced penalties for noncompliance.
- The law establishes new requirements to report financial arrangements with physicians and teaching hospitals and to annually report drug samples that manufacturers and distributors provide to physicians.
- The law establishes a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research.
- The law established the Center for Medicare and Medicaid Innovation within CMS to test innovative payment and service delivery methods.

In addition, other legislative changes have been proposed and adopted since the ACA was enacted. In August 2011, the Budget Control Act of 2011, among other things, created measures for spending reductions by Congress. A Joint Select Committee on Deficit Reduction, tasked with recommending a targeted deficit reduction of at least $1.2 trillion for the years 2013 through 2021, was unable to reach required goals, thereby triggering the legislation's automatic reduction to several government programs. These changes included aggregate reductions to Medicare payments to providers of 2% per fiscal year. These reductions went into effect on April 1, 2013 and, due to subsequent legislative amendments to the statute, will remain in effect through 2030, with the exception of a temporary suspension from May 1, 2020 through March 31, 2022 due to the COVID-19 pandemic. Following the suspension, a 1% payment reduction began April 1, 2022, lasting through June 30, 2022. The 2% payment reduction resumed on July 1, 2022. The American Taxpayer Relief Act of 2012, among other things, reduced Medicare payments to several providers and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. These new laws may result in additional reductions in Medicare and other healthcare funding and otherwise affect the prices we may obtain for our approved products or any of our product candidates for which we may obtain regulatory approval, or the frequency with which our products or any future product is prescribed or used.

Further, there have been several changes to the 340B Drug Pricing Program, which imposes ceilings on prices that drug manufacturers can charge for medications sold to certain healthcare facilities. On December 27, 2018, the District Court for the District of Columbia invalidated a reimbursement formula change under the 340B Drug Pricing Program, and CMS subsequently altered the fiscal years 2019 and 2018 reimbursement formula on specified covered outpatient drugs. The court ruled this change was not an "adjustment" which was within the Secretary's discretion to make but was instead a fundamental change in the reimbursement calculation. However, most recently, on July 31, 2020, the U.S. Court of Appeals for the District of Columbia Circuit overturned the district court's decision and found that the changes were within the Secretary's authority. On September 14, 2020, the plaintiffs-appellees filed a Petition for Rehearing En Banc (i.e., before the full court), and the court denied this petition on October 16, 2020. Plaintiffs-appellees filed a petition for a writ of certiorari at the Supreme Court on February 10, 2021. On July 2, 2021, the Supreme Court granted the petition. On June 15, 2022, the Supreme Court unanimously reversed the Court of Appeals' decision, holding that HHS's 2018 and 2019 reimbursement rates for 340B hospitals were contrary to the statute and unlawful. It is unclear how these developments could affect covered hospitals who might purchase our future products and affect the rates we may charge such facilities for our approved products in the future, if any.

The IRA, which among other things, allows for CMS to negotiate prices for certain single-source drugs and biologics reimbursed under Medicare Part B and Part D, beginning with ten high-cost drugs paid for by Medicare Part D starting in 2026, followed by 15 Part D drugs in 2027, 15 Part B or Part D drugs in 2028, and 20 Part B or Part D drugs in 2029 and beyond. The legislation subjects drug manufacturers to civil monetary penalties and a potential excise tax for failing to comply with the legislation by offering a price that is not equal to or less than the negotiated "maximum fair price" under the law or for taking price increases that exceed inflation. The legislation also requires manufacturers to pay rebates for drugs in Medicare Part D whose price increases exceed inflation. Further, the legislation caps Medicare beneficiaries' annual out-of-pocket drug expenses at $2,000. Under the IRA, a second FDA approval for vutrisiran for Stargardt Disease would cause us to lose the single-orphan exemption for AMVUTTRA from Medicare price negotiation. As a result, in October 2022, we announced we would not pursue a Phase 3 clinical trial to study vutrisiran in Stargardt Disease. The effect of the IRA on our business and the healthcare industry in general is developing and may have an additional adverse impact on our industry.

The full effects of the U.S. healthcare reform legislation cannot be known until the law is fully implemented through regulations or guidance issued by CMS and other federal and state healthcare agencies. The financial impact of the U.S. healthcare reform legislation over the next few years will depend on a number of factors, including, but not limited, to the policies reflected in implementing regulations and guidance, and changes in sales volumes for products affected by the new system of rebates, discounts and fees. This legislation may also have a positive impact on our future net sales, if any, by increasing the aggregate number of persons with healthcare coverage in the U.S.

Since its enactment, there have been numerous judicial, administrative, executive, and legislative challenges to certain aspects of the ACA, and we expect there will be additional challenges and amendments to the ACA in the future. On June 17, 2021, the U.S. Supreme Court dismissed the most recent judicial challenge to the ACA brought by several states without specifically ruling on the constitutionality of the ACA. Prior to the Supreme Court's decision, President Biden issued an executive order to initiate a special enrollment period from February 15, 2021 through August 15, 2021 for the purpose of obtaining health insurance coverage through the ACA marketplace. The executive order also instructed certain governmental agencies to review and reconsider their existing policies and rules that limit access to healthcare, including among others, reexamining Medicaid demonstration projects and waiver programs that include work requirements, and policies that create unnecessary barriers to obtaining access to health insurance coverage through Medicaid or the ACA. It is unclear how other healthcare reform measures of the Biden administration or other efforts, if any, to challenge, repeal or replace the ACA will impact our business.

At the state level, legislatures have become increasingly aggressive in passing legislation and implementing regulations designed to control pharmaceutical product pricing. Some of these measures include price or patient reimbursement constraints, discounts, restrictions on certain product access, marketing cost disclosure and transparency measures, and, in some cases, measures designed to encourage importation from other countries and bulk purchasing. In addition, regional healthcare 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 healthcare programs. These measures could reduce the ultimate demand for our products, once approved, or put pressure on our product pricing.

We cannot predict what healthcare reform initiatives may be adopted in the future. Further federal and state legislative and regulatory developments are likely, and we expect ongoing initiatives in the U.S. to increase pressure on drug pricing. Such reforms could have an adverse effect on anticipated revenues from one or more of our approved products or other product candidates that we may successfully develop and for which we may obtain regulatory approval and may affect our overall financial condition and ability to develop drug candidates.

We are subject to U.S. and certain foreign export and import controls, sanctions, embargoes, anti-corruption laws, and anti-money laundering laws and regulations. Failure to comply with these legal standards could impair our ability to compete in domestic and international markets. We can face criminal liability and other serious consequences for violations, which can harm our business.

We are subject to export control and import laws and regulations, including the U.S. Export Administration Regulations, U.S. Customs regulations, various economic and trade sanctions regulations administered by the U.S. Treasury Department’s Office of Foreign Assets Control, the FCPA, the U.S. domestic bribery statute contained in 18 U.S.C. § 201, the U.S. Travel Act, the USA PATRIOT Act, and other state and national anti-bribery and anti-money laundering laws in the countries in which we conduct activities. Anti-corruption laws are interpreted broadly and prohibit companies and their employees, agents, contractors, and other collaborators from authorizing, promising, offering, or providing, directly or indirectly, improper payments or anything else of value to recipients in the public or private sector. From time to time, we may engage third parties to conduct clinical trials outside of the U.S., to sell our products abroad, and/or to obtain necessary permits, licenses, patent registrations, and other regulatory approvals. We have direct or indirect interactions with officials and employees of government agencies or government-affiliated hospitals, universities, and other organizations. We can be held liable for the corrupt or other illegal activities of our employees, agents, contractors, and other collaborators, even if we do not explicitly authorize or have actual knowledge of such activities. Any violations of the laws and regulations described above may result in substantial civil and criminal fines and penalties, imprisonment, the loss of export or import privileges, debarment, tax reassessments, breach of contract and fraud litigation, reputational harm, and other consequences.

We remain focused on these laws and the activities they regulate and, as detailed above, maintain a global compliance program designed to empower our business to operate in compliance with their requirements.

Governments outside the U.S. may impose strict price controls, which may adversely affect our revenues.

The pricing of prescription pharmaceuticals is also subject to governmental control outside the U.S. In these countries, pricing negotiations with governmental authorities can take considerable time after the receipt of regulatory approval for a product. To obtain reimbursement or pricing approval in some countries, we may be required to conduct a clinical trial that compares the cost-effectiveness of our product candidates to other available therapies. If reimbursement of our products is unavailable or limited in scope or amount, or if pricing is set at unsatisfactory levels, our ability to generate revenues and become profitable could be impaired.

In some countries, including Member States of the EU, or Japan, the pricing of prescription drugs is subject to governmental control. Additional countries may adopt similar approaches to the pricing of prescription drugs. In such countries, pricing negotiations with governmental authorities can take considerable time after receipt of regulatory approval for a product. In addition, there can be considerable pressure by governments and other stakeholders on prices and reimbursement levels, including as part of cost containment measures. Moreover, political, economic and regulatory developments may further complicate pricing negotiations, and pricing negotiations may continue after coverage and reimbursement have been obtained. Reference pricing used by various countries and parallel distribution, or arbitrage between low-priced and high-priced countries, can further reduce prices. In some countries, we may be required to conduct a clinical study or other studies that compare the cost-effectiveness of a product candidate to other available therapies in order to obtain or maintain reimbursement or pricing approval, which is time-consuming and costly. We cannot be sure that such prices and reimbursement will be acceptable to us or our strategic partners. Publication of discounts by third-party payors or authorities may lead to further pressure on the prices or reimbursement levels within the country of publication and other countries. If pricing is set at unsatisfactory levels or if reimbursement of our products is unavailable or limited in scope or amount, our revenues from sales by us or our strategic partners and the potential profitability of our approved products or any future products in those countries would be negatively affected. Another impact from the tightening pricing control could be felt from greater competition from less expensive generic or biosimilar products once the exclusivity expires; the governments have adopted policies to switch prescribed products to generic versions in order to cut the medical cost.

If we or our collaborators, CMOs or service providers fail to comply with healthcare laws and regulations, or legal obligations related to privacy, data protection and information security, we or they could be subject to enforcement actions, which could affect our ability to develop, market and sell our products and may harm our reputation.

As a manufacturer of pharmaceuticals, we are subject to federal, state, and comparable foreign healthcare laws and regulations pertaining to fraud and abuse and patients' rights, in addition to legal obligations related to privacy, data protection and information security. These laws and regulations include:

- The U.S. federal Anti-Kickback Statute, which prohibits, among other things, persons or entities from knowingly and willfully soliciting, receiving, offering or paying any remuneration (including any kickback, bribe or rebate), directly or indirectly, overtly or covertly, in cash or in kind, to induce, or in return for, the purchase, lease, order, arrangement, or recommendation of any good, facility, item or service for which payment may be made, in whole or in part, under a federal healthcare program, such as the Medicare and Medicaid programs. A person or entity does not need to have actual knowledge of the federal Anti-Kickback Statute or specific intent to violate it to have committed a violation. Violations are subject to civil and criminal fines and penalties for each violation, plus up to three times the remuneration involved, imprisonment, and exclusion from government healthcare programs. In addition, the government may assert that a claim including items or services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the federal FCA or federal civil money penalties.
- The U.S. federal false claims laws, including the FCA, which prohibit, among other things, individuals or entities from knowingly presenting or causing to be presented, claims for payment by government-funded programs such as Medicare or Medicaid that are false or fraudulent, making, using or causing to be made or used a false record or statement material to a false or fraudulent claim to the federal government, or making a false statement to avoid, decrease or conceal an obligation to pay money to the federal government. Manufacturers can be held liable under the FCA even when they do not submit claims directly to government payors if they are deemed to "cause" the submission of false or fraudulent claims. The FCA also permits a private individual acting as a "whistleblower" to bring actions on behalf of the federal government alleging violations of the FCA and to share in any monetary recovery.
- The federal civil monetary penalties laws, which impose civil fines for, among other things, the offering or transfer of remuneration to a Medicare or state healthcare program beneficiary if the person knows or should know it is likely to influence the beneficiary's selection of a particular provider, practitioner, or supplier of services reimbursable by Medicare or a state healthcare program, unless an exception applies.
- The federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, which created federal criminal statutes that prohibit knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program or obtain, by means of false or fraudulent pretenses, representations, or promises, any of the money or property owned by, or under the custody or control of, any healthcare benefit program, regardless of the payor (e.g., public or private) and knowingly and willfully falsifying, concealing or covering up by any trick or device a material fact or making any materially false statements in connection with the delivery of, or payment for, healthcare benefits, items or services relating to healthcare matters. Similar to the federal Anti-Kickback Statute, a person or entity can be found guilty of violating HIPAA without actual knowledge of the statute or specific intent to violate it.
- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, which imposes requirements relating to the privacy, security, and transmission of individually identifiable health information; and requires notification to affected individuals and regulatory authorities of certain breaches of security of individually identifiable health information.

- Federal "sunshine" requirements imposed by the ACA on drug, device, biological and medical supply manufacturers when payment is available under Medicare, Medicaid or the Children's Health Insurance Program (with certain exceptions) to report annually to HHS under the Open Payments Program, information regarding any payment or other "transfer of value" made or distributed to physicians (defined to include doctors, dentists, optometrists, podiatrists and chiropractors), certain non-physician providers such as physician assistants and nurse practitioners, and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members. Failure to submit required information may result in civil monetary penalties for all payments, transfers of value or ownership or investment interests that are not timely, accurately, and completely reported in an annual submission.
- Federal price reporting laws, which require manufacturers to calculate and report complex pricing metrics to government programs, where such reported prices may be used in the calculation of reimbursement and/or discounts on approved products.
- Federal statutory and regulatory requirements applicable to pricing and sales of product to Federal Government Agencies.
- Federal consumer protection and unfair competition laws, which broadly regulate marketplace activities and activities that potentially harm consumers.
- State and foreign laws comparable to each of the above federal laws, including in the EU laws prohibiting giving healthcare professionals any gift or benefit in kind as an inducement to prescribe our products, national transparency laws requiring the public disclosure of payments made to healthcare professionals and institutions, and data privacy laws, in addition to anti-kickback and false claims laws applicable to commercial insurers and other non-federal payors, requirements for mandatory corporate regulatory compliance programs, and laws relating to government reimbursement programs, patient data privacy and security.
- European privacy laws including Regulation 2016/679, known as the General Data Protection Regulation, or the EU GDPR, and the EU GDPR as transposed into the laws of the UK, the UK GDPR, collectively referred to as the GDPR, and the e-Privacy Directive (2002/58/EC), and the national laws implementing each of them, as well as the Public and Electronic Communications Regulations 2003 in the UK and the privacy laws of Japan and other territories. Failure to comply with our obligations under the privacy regime could expose us to significant fines and/or adverse publicity, which could have material adverse effects on our reputation and business.
- The California Consumer Privacy Act of 2018, or CCPA, effective as of January 1, 2020, that gives California residents expanded rights to access and require deletion of their personal information, opt out of certain personal information sharing, and receive detailed information about how their personal information is used. The CCPA provides for civil penalties for violations, as well as a private right of action for data breaches that is expected to increase data breach litigation.
- Additionally, a new California ballot initiative, the California Privacy Rights Act of 2020, or CPRA, was passed in November 2020. Effective as of January 1, 2023, the CPRA imposes additional obligations on companies covered by the legislation and will significantly modify the CCPA, including by expanding consumers' rights with respect to certain sensitive personal information. The CPRA also creates a new state agency that will be vested with authority to implement and enforce the CCPA and the CPRA. Furthermore, similar laws were enacted in four other states and proposed in numerous others. The effects of the CCPA and the CPRA are potentially significant and may require us to modify our data collection or processing practices and policies and to incur substantial costs and expenses in an effort to comply and increase our potential exposure to regulatory enforcement and/or litigation.

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

If our operations are found to be in violation of any of the aforementioned requirements, we may be subject to penalties, including civil or criminal penalties (including individual imprisonment), criminal prosecution, monetary damages, the curtailment or restructuring of our operations, loss of eligibility to obtain approvals from the FDA, or exclusion from participation in government contracting, healthcare reimbursement or other government programs, including Medicare and Medicaid, or the imposition of a corporate integrity agreement with the Office of Inspector General of the Department of Health and Human Services, any of which could adversely affect our financial results. We remain focused on enhancing our global compliance infrastructure following the commercial launch of our four products over the last four years in the U.S., EU and multiple other geographies, and as we prepare for the launch of our products in additional countries, assuming regulatory approvals. Although effective compliance programs can mitigate the risk of investigation and prosecution for violations of these laws, these risks cannot be entirely eliminated. For additional information, see the Risk Factor captioned "We may incur significant liability if enforcement authorities allege or determine that we are engaging in commercial activities or promoting

our commercially approved products in a way that violates applicable regulations." Any action against us for an alleged or suspected violation could cause us to incur significant legal expenses and could divert our management's attention from the operation of our business, even if our defense is successful. In addition, achieving and sustaining compliance with applicable laws and regulations may be costly to us in terms of money, time and resources.

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

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

Moreover, federal, state or foreign laws or regulations are subject to change, and while we, our collaborators, CMOs and/or service providers currently may be compliant, that could change due to changes in interpretation, prevailing industry standards or the legal structure.

Third party patient assistance programs that receive financial support from companies have become the subject of enhanced government and regulatory scrutiny. The OIG has established guidelines that suggest that it is lawful for pharmaceutical manufacturers to make donations to charitable organizations who provide co-pay assistance to Medicare patients, provided that such organizations, among other things, are bona fide charities, are entirely independent of and not controlled by the manufacturer, provide aid to applicants on a first-come basis according to consistent financial criteria and do not link aid to use of a donor's product. However, donations to patient assistance programs have received some negative publicity and have been the subject of multiple government enforcement actions, related to allegations regarding their use to promote branded pharmaceutical products over other less costly alternatives. Specifically, in recent years, there have been multiple settlements resulting out of government claims challenging the legality of their patient assistance programs under a variety of federal and state laws. It is possible that we may make grants to independent charitable foundations that help financially needy patients with their premium, co-pay, and co-insurance obligations. If we choose to do so, and if we or our vendors or donation recipients are deemed to fail to comply with relevant laws, regulations or evolving government guidance in the operation of these programs, we could be subject to damages, fines, penalties, or other criminal, civil, or administrative sanctions or enforcement actions. We cannot ensure that our compliance controls, policies, and procedures will be sufficient to protect against acts of our employees, business partners, or vendors that may violate the laws or regulations of the jurisdictions in which we operate. Regardless of whether we have complied with the law, a government investigation could impact our business practices, harm our reputation, divert the attention of management, increase our expenses, and reduce the availability of foundation support for our patients who need assistance.

We are subject to governmental regulation and other legal obligations, particularly related to privacy, data protection and information security, and we are subject to consumer protection laws that regulate our marketing practices and prohibit unfair or deceptive acts or practices. Our actual or perceived failure to comply with such obligations could harm our business.

The GDPR imposes strict requirements on controllers and processors of personal data, including special protections for "special category data," which includes health, biometric and genetic information of data subjects located in the EEA and UK. Further, GDPR provides a broad right for EEA Member States to create supplemental national laws, such as laws relating to the processing of health, genetic and biometric data, which could further limit our ability to use and share such data or could cause our costs to increase, and harm our business and financial condition.

Failure to comply with the requirements of the GDPR and the related national data protection laws of the EEA Member States and the UK, which may deviate slightly from the GDPR, may result in fines of up to 4% of total global annual revenue, or €20.0 million (£17.5 million under the UK GDPR), whichever is greater, and in addition to such fines, we may be the subject of litigation and/or adverse publicity, which could have a material adverse effect on our reputation and business. As a result of the implementation of the GDPR, we are required to put in place a number of measures to ensure compliance with the data protection regime. The GDPR requires us to inform data subjects of how we process their personal data and how they can exercise their rights, ensure we have a valid legal basis to process personal data (if this is consent, the requirements for obtaining consent carries a higher threshold), appoint a data protection officer where sensitive personal data (i.e., health data) is processed on a large scale, introduces mandatory data breach notification requirements throughout the EEA and UK, requires us to maintain records of our processing activities and to document data protection impact assessments where there is high risk processing, imposes additional obligations on us when we are contracting with service providers, requires appropriate technical and organisational measures to be put in place to safeguard personal data and requires us to adopt appropriate privacy governance including policies, procedures, training and data audit.

Significantly, the GDPR imposes strict rules on the transfer of personal data out of the EEA and UK to the U.S. or other regions that have not been deemed to offer "adequate" privacy protections. In the past, companies in the U.S. were able to rely upon the EU-U.S., UK-U.S. and the Swiss-U.S. Privacy Shield frameworks to legitimize data transfers from the EU and the UK to the U.S. In July 2020, the Court of Justice of the European Union, or CJEU, in Case C-311/18 (Data Protection Commissioner v Facebook Ireland and Maximillian Schrems, or Schrems II) invalidated the EU-U.S. Privacy Shield on the grounds that the Privacy Shield failed to offer adequate protections to EU personal data transferred to the U.S. The CJEU, in the same decision, deemed that the Standard Contractual Clauses, or SCCs, published by the EC are valid. However, the CJEU ruled that transfers made pursuant to the SCCs need to be assessed on a case-by-case basis to ensure the law in the recipient country provides "essentially equivalent" protections to safeguard the transferred personal data as the EU, and required businesses to adopt supplementary measures if such standard is not met. Subsequent guidance published by the European Data Protection Board in June 2021 described what such supplementary measures must be, and stated that businesses should avoid or cease transfers of personal data if, in the absence of supplementary measures, equivalent protections cannot be afforded. On June 4, 2021, the EC published new versions of the SCCs, which seek to address the issues identified by the CJEU's Schrems II decision and provide further details regarding the transfer assessments that the parties are required to conduct when implementing the New SCCs. However, there continue to be concerns about whether the SCCs and other mechanisms will face additional challenges. Similarly, the Swiss data protection authority determined the Swiss-U.S. Privacy Shield framework was no longer a valid mechanism for Swiss-U.S. data transfers and also raised questions about the validity of the SCCs as a mechanism for transferring personal data from Switzerland. While SCCs provide an alternative to our Privacy Shield certification for EU-U.S. data flows, the decision (and certain regulatory guidance issued in its wake) casts doubt on the legality of EU-U.S. data flows in general. Any inability to transfer personal data from the EU to the U.S. in compliance with data protection laws may impede our ability to conduct trials and may adversely affect our business and financial position. The UK is not subject to the EC's new SCCs but has published its own transfer mechanism, the International Data Transfer Agreement or International Data Transfer Addendum, which enables transfers from the UK. On March 25, 2022, the EC and the U.S. announced to have reached a political agreement on a new "Trans-Atlantic Data Privacy Framework", which will replace the invalidated Privacy Shield and on December 13, 2022, the EC published a draft adequacy decision on the Trans-Atlantic Data Privacy Framework.

EEA Member States have adopted implementing national laws to implement the GDPR which may partially deviate from the GDPR and the competent authorities in the EEA Member States may interpret GDPR obligations slightly differently from country to country, so that we do not expect to operate in a uniform legal landscape in the EU. In addition, the UK has announced plans to reform the country's data protection legal framework in its Data Reform Bill, but these have been put on hold.

We are subject to the supervision of local data protection authorities in those jurisdictions where we are monitoring the behavior of individuals in the EEA or UK (i.e., undertaking clinical trials). We depend on a number of third parties in relation to the provision of our services, a number of which process personal data of EU and/or UK individuals on our behalf. With each such provider we enter or intend to enter into contractual arrangements under which they are contractually obligated to only process personal data according to our instructions, and conduct or intend to conduct diligence to ensure that they have sufficient technical and organizational security measures in place.

We are also subject to evolving European privacy laws on electronic marketing and cookies. The EU is in the process of replacing the e-Privacy Directive (2002/58/EC) with a new set of rules taking the form of a regulation, which will be directly implemented in the laws of each European member state, without the need for further enactment. While the e-Privacy Regulation was originally intended to be adopted on May 25, 2018 (alongside the GDPR), it is still going through the European legislative process. Draft regulations were rejected by the Permanent Representatives Committee of the Council of EU on November 22, 2019; it is not clear when new regulations will be adopted.

Compliance with U.S. and international data protection laws and regulations could require us to take on more onerous obligations in our contracts, restrict our ability to collect, use and disclose data, or in some cases, impact our ability to operate in certain jurisdictions. Failure to comply with these laws and regulations could result in government enforcement actions

(which could include civil, criminal and administrative penalties), private litigation, and/or adverse publicity and could negatively affect our operating results and business. Moreover, clinical trial subjects, employees and other individuals about whom we or our potential collaborators obtain personal information, as well as the providers who share this information with us, may limit our ability to collect, use and disclose the information. Claims that we have violated individuals' privacy rights, failed to comply with data protection laws, or breached our contractual obligations, even if we are not found liable, could be expensive and time-consuming to defend and could result in adverse publicity that could harm our business.

Our ability to obtain services, reimbursement or funding from the federal government may be impacted by possible reductions in federal spending and services, and any inability on our part to effectively adapt to such changes could substantially affect our financial position, results of operations and cash flows.

Under the Budget Control Act of 2011, the failure of Congress to enact deficit reduction measures of at least $1.2 trillion for the years 2013 through 2021 triggered automatic cuts to most federal programs. These cuts included aggregate reductions to Medicare payments to providers of up to 2% per fiscal year, starting in 2013. Certain of these automatic cuts have been implemented resulting in reductions in Medicare payments to physicians, hospitals, and other healthcare providers, among other things. Due to legislation amending the statute, including the Bipartisan Budget Act of 2018, these reductions will stay in effect through 2030 unless additional Congressional action is taken. Pursuant to the CARES Act, as well as subsequent legislation, these reductions were suspended from May 1, 2020 through December 31, 2021 due to the COVID-19 pandemic. The full impact on our business of these automatic cuts is uncertain.

If other federal spending is reduced, any budgetary shortfalls may also impact the ability of relevant agencies, such as the FDA or the NIH to continue to function. Amounts allocated to federal grants and contracts may be reduced or eliminated. These reductions may also impact the ability of relevant agencies to timely review and approve drug research and development, manufacturing, and marketing activities, which may delay our ability to develop, market and sell our approved products and any other products we may develop. Further, there has been heightened governmental scrutiny recently over the manner in which drug manufacturers set prices for their marketed products, which has resulted in several Congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drug products.

There is a substantial risk of product liability claims in our business. If we are unable to obtain sufficient insurance, a product liability claim against us could adversely affect our business.

Our business exposes us to significant potential product liability risks that are inherent in the development, testing, manufacturing and marketing of human therapeutic products. Product liability claims could delay or prevent completion of our clinical development programs. Following the decision to discontinue clinical development of revusiran, we conducted a comprehensive evaluation of available revusiran data. We reported the results of this evaluation in August 2017, however, our investigation did not result in a conclusive explanation regarding the cause of the mortality imbalance observed in the ENDEAVOUR Phase 3 study. In addition, in September 2017, we announced that we had temporarily suspended dosing in all ongoing fitusiran studies pending further review of a fatal thrombotic SAE and agreement with regulatory authorities on a risk mitigation strategy. Notwithstanding the risks undertaken by all persons who participate in clinical trials, and the information on risks provided to study investigators and patients participating in our clinical trials, including the revusiran and fitusiran studies, it is possible that product liability claims will be asserted against us relating to the worsening of a patient's condition, injury or death alleged to have been caused by one of our product candidates, including revusiran or fitusiran. Such claims might not be fully covered by product liability insurance. In addition, product liability claims could result in an FDA investigation of the safety and effectiveness of our approved products, our manufacturing processes and facilities or our marketing programs, and potentially a recall of our products or more serious enforcement action, limitations on the approved indications for which they may be used, or suspension or withdrawal of approvals. Regardless of the merits or eventual outcome, liability claims may also result in decreased demand for our products, injury to our reputation, costs to defend the related litigation, a diversion of management's time and our resources, substantial monetary awards to trial participants or patients and a decline in our stock price. We currently have product liability insurance that we believe is appropriate for our stage of development, including the marketing and sale of our approved products. Any insurance we have or may obtain may not provide sufficient coverage against potential liabilities. Furthermore, clinical trial and product liability insurance is becoming increasingly expensive. As a result, we may be unable to obtain sufficient insurance at a reasonable cost to protect us against losses caused by product liability claims that could have a material adverse effect on our business.

Our employees may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements or insider trading violations, which could significantly harm our business.

We are exposed to the risk of employee fraud or other misconduct. Misconduct by employees could include intentional failures to comply with governmental regulations, comply with healthcare fraud and abuse and anti-kickback laws and regulations in the U.S. and abroad, or failure to report financial information or data accurately or disclose unauthorized activities to us. In particular, sales, marketing and business arrangements in the healthcare industry are subject to extensive laws and regulations intended to prevent fraud, misconduct, kickbacks, self-dealing and other abusive practices. These laws and

regulations may restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, customer incentive programs and other business arrangements. Employee misconduct could also involve the improper use of, including improper trading based upon, information obtained in the course of clinical studies, which could result in regulatory sanctions and serious harm to our reputation. We maintain a global compliance program and remain focused on its evolution and enhancement. Our program includes efforts such as risk assessment and monitoring, fostering a speak up culture encouraging employees and third parties to raise good faith questions or concerns, and defined processes and systems for reviewing and remediating allegations and identified potential concerns. It is not always possible, however, to identify and deter employee misconduct, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to comply with these laws or regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business and results of operations, including the imposition of significant fines or other sanctions.

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

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

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

Risks Related to Patents, Licenses and Trade Secrets

If we are not able to obtain and enforce patent protection for our discoveries, our ability to develop and commercialize our product candidates will be harmed.

Our success depends, in part, on our ability to protect proprietary compositions, methods and technologies that we develop under the patent and other intellectual property laws of the U.S. and other countries, so that we can prevent others from unlawfully using our inventions and proprietary information. However, we may not hold proprietary rights to some patents required for us to manufacture and commercialize our proposed products. Because certain U.S. patent applications are confidential until the patents issue, such as applications filed prior to November 29, 2000, or applications filed after such date which will not be filed in foreign countries, third parties may have filed patent applications for subject matter covered by our pending patent applications without our being aware of those applications, and our patent applications may not have priority over those applications. For this and other reasons, we may be unable to secure desired patent rights, thereby losing desired exclusivity. Further, we or our licensees may be required to obtain licenses under third-party patents to market one or more of our or our partner's approved products, or further develop and commercialize future products, or continue to develop candidates in our pipeline being developed by us or our licensees. If licenses are not available to us or not available on reasonable terms, we or our licensees may not be able to market the affected products or conduct the desired activities.

Our strategy depends on our ability to rapidly identify and seek patent protection for our discoveries. In addition, we may rely on third-party collaborators to file patent applications relating to proprietary technology that we develop jointly during certain collaborations. The process of obtaining patent protection is expensive and time-consuming. If our present or future collaborators fail to file and prosecute all necessary and desirable patent applications at a reasonable cost and in a timely manner, our business may be adversely affected. Despite our efforts and the efforts of our collaborators to protect our proprietary rights, unauthorized parties may be able to obtain and use information that we regard as proprietary. While issued patents are presumed valid, this does not guarantee that the patent will survive a validity challenge or be held enforceable. Any patents we have obtained, or obtain in the future, may be challenged, invalidated, adjudged unenforceable or circumvented by parties attempting to design around our intellectual property. Moreover, third parties or the United States Patent and Trademark Office, or USPTO, may commence interference proceedings involving our patents or patent applications. Any challenge to,

finding of unenforceability or invalidation or circumvention of, our patents or patent applications, would be costly, would require significant time and attention of our management, could reduce or eliminate royalty payments to us from third party licensors and could have a material adverse effect on our business.

Our pending patent applications may not result in issued patents. The patent position of pharmaceutical or biotechnology companies, including ours, is generally uncertain and involves complex legal and factual considerations. The standards that the USPTO and its foreign counterparts use to grant patents are not always applied predictably or uniformly and can change. Similarly, the ultimate degree of protection that will be afforded to biotechnology inventions, including ours, in the U.S. and foreign countries, remains uncertain and is dependent upon the scope of the protection decided upon by patent offices, courts and lawmakers. Moreover, there are periodic discussions in the Congress of the United States and in international jurisdictions about modifying various aspects of patent law. For example, the America Invents Act, or AIA, included a number of changes to the patent laws of the U.S. If any of the enacted changes do not provide adequate protection for discoveries, including our ability to pursue infringers of our patents for substantial damages, our business could be adversely affected. One major provision of the AIA, which took effect in March 2013, changed U.S. patent practice from a first-to-invent to a first-to-file system. If we fail to file an invention before a competitor files on the same invention, we no longer have the ability to provide proof that we were in possession of the invention prior to the competitor's filing date, and thus would not be able to obtain patent protection for our invention. There is also no uniform, worldwide policy regarding the subject matter and scope of claims granted or allowable in pharmaceutical or biotechnology patents.

Accordingly, we do not know the degree of future protection for our proprietary rights or the breadth of claims that will be allowed in any patents issued to us or to others. We also rely to a certain extent on trade secrets, know-how and technology, which are not protected by patents, to maintain our competitive position. If any trade secret, know-how or other technology not protected by a patent were to be disclosed to or independently developed by a competitor, our business and financial condition could be materially adversely affected.

Failure to obtain and maintain all available regulatory exclusivities, broad patent scope and to maximize patent term restoration or extension on patents covering our products may lead to loss of exclusivity and early generic entry resulting in a loss of market share and/or revenue.

We license patent rights from third-party owners. If such owners do not properly or successfully obtain, maintain or enforce the patents underlying such licenses, our competitive position and business prospects may be harmed.

We are a party to a number of licenses that give us rights to third-party intellectual property that is necessary or useful for our business. In particular, we have obtained licenses from, among others, Ionis, Arbutus, and Dicerna. We also intend to enter into additional licenses to third-party intellectual property in the future.

Our success will depend in part on the ability of our licensors to obtain, maintain and enforce patent protection for our licensed intellectual property, in particular, those patents to which we have secured exclusive rights. Our licensors may not successfully prosecute the patent applications to which we are licensed. Even if patents issue in respect of these patent applications, our licensors may fail to maintain these patents, may determine not to pursue litigation against other companies that are infringing these patents, or may pursue such litigation less aggressively than we would. Without protection for the intellectual property we license, other companies might be able to offer substantially identical products for sale, which could adversely affect our competitive business position and harm our business prospects. In addition, we sublicense our rights under various third-party licenses to our collaborators. Any impairment of these sublicensed rights could result in reduced revenues under our collaboration agreements or result in termination of an agreement by one or more of our collaborators.

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

RNAi is a relatively new scientific field, the commercial exploitation of which has resulted in many different patents and patent applications from organizations and individuals seeking to obtain patent protection in the field. We have obtained grants and issuances of RNAi patents and have licensed many of these patents from third parties on an exclusive basis. The issued patents and pending patent applications in the U.S. and in key markets around the world that we own or license claim many different methods, compositions and processes relating to the discovery, development, manufacture and commercialization of RNAi therapeutics.

Specifically, we have a portfolio of patents, patent applications and other intellectual property covering: fundamental aspects of the structure and uses of siRNAs, including their use as therapeutics, and RNAi-related mechanisms; chemical modifications to siRNAs that improve their suitability for therapeutic and other uses; siRNAs directed to specific targets as treatments for particular diseases; delivery technologies, such as in the fields of carbohydrate conjugates and cationic liposomes; and all aspects of our specific development candidates.

As the field of RNAi therapeutics is maturing, patent applications are being fully processed by national patent offices around the world. There is uncertainty about which patents will issue, and, if they do, as to when, to whom, and with what claims. It is likely that there will be significant litigation and other proceedings, such as interference, re-examination and opposition proceedings, as well as *inter partes* and post-grant review proceedings introduced by provisions of the AIA, which

became available to third party challengers on September 16, 2012, in various patent offices relating to patent rights in the RNAi field. In addition, third parties may challenge the validity of our patents. For example, a third party has filed an opposition in the European Patent Office, or EPO, against our owned patent EP 2723758, with claims directed to compositions and methods of ANGPTL3, arguing that the granted claims are invalid. An oral hearing was held at the EPO in February 2021, where the patent was revoked. A notice of appeal of the EPO's decision was filed in June 2021. In addition, in February 2023, a third party filed an opposition with the EPO against our owned patent EP 3366775, titled "Modified RNA Agents" seeking to revoke the patent. An oral hearing is anticipated at a time to be determined by the EPO. We expect that additional oppositions will be filed in the EPO and elsewhere, and other challenges will be raised relating to other patents and patent applications in our portfolio. In many cases, the possibility of appeal exists for either us or our opponents, and it may be years before final, unappealable rulings are made with respect to these patents in certain jurisdictions. The timing and outcome of these and other proceedings is uncertain and may adversely affect our business if we are not successful in defending the patentability and scope of our pending and issued patent claims. Even if our rights are not directly challenged, disputes could lead to the weakening of our intellectual property rights. Our defense against any attempt by third parties to circumvent or invalidate our intellectual property rights could be costly to us, could require significant time and attention of our management and could have a material adverse effect on our business and our ability to successfully compete in the field of RNAi.

There are many issued and pending patents that claim aspects of oligonucleotide chemistry and modifications that we may need for our siRNA products marketed by us or our licensees, our late-stage therapeutic candidates being developed by us or our licensees, including zilebesiran and fitusiran, as well as our other pipeline products. There are also many issued patents that claim targeting genes or portions of genes that may be relevant for siRNA drugs we wish to develop. In addition, there may be issued and pending patent applications that may be asserted against us in a court proceeding or otherwise based upon the asserting party's belief that we may need such patents for our siRNA therapeutic candidates or marketed products, or to further develop and commercialize future products, or to continue to develop candidates in our pipeline that are being developed by us or our licensees. Thus, it is possible that one or more organizations will hold patent rights to which we may need a license, or hold patent rights which could be asserted against us. If those organizations refuse to grant us a license to such patent rights on reasonable terms and/or a court rules that we need such patent rights that have been asserted against us and we are not able to obtain a license on reasonable terms, we may be unable to market products, including ONPATTRO, AMVUTTRA, GIVLAARI or OXLUMO, or perform research and development or other activities covered by such patents. For example, during 2017 and 2018, Silence filed claims in several jurisdictions, including the High Court of England and Wales, and named us and our wholly owned subsidiary Alnylam UK Ltd. as co-defendants. Silence alleged various claims, including that ONPATTRO infringed one or more Silence patents. There were also a number of related actions brought by us or Silence in connection with this intellectual property dispute. In December 2018, we entered into a Settlement and License Agreement with Silence, resolving all ongoing claims, administrative proceedings, and regulatory proceedings worldwide between us regarding, among other issues, patent infringement, patent invalidity and breach of contract.

If we become involved in intellectual property litigation or other proceedings related to a determination of rights, we could incur substantial costs and expenses, and in the case of such litigation or proceedings against us, substantial liability for damages or be required to stop our product development and commercialization efforts.

Third parties may sue us for infringing their patent rights. For example, in October 2017 Silence sued us in the UK alleging that ONPATTRO and other investigational RNAi therapeutics we or MDCO are developing infringed one or more Silence patents. In December 2018 we and Silence settled all ongoing litigation between us. A third party may also claim that we have improperly obtained or used its confidential or proprietary information.

Furthermore, third parties may challenge the inventorship of our patents or licensed patents. For example, in March 2011, The University of Utah, or Utah, filed a complaint against us, Max Planck Gesellschaft Zur Foerderung Der Wissenschaften e.V. and Max Planck Innovation, together, Max Planck, Whitehead, MIT and the University of Massachusetts, claiming that a professor of Utah was the sole inventor, or in the alternative, a joint inventor of certain of our in-licensed patents. Utah was seeking correction of inventorship of the Tuschl patents, unspecified damages and other relief. After several years of court proceedings and discovery, the court granted our motions for summary judgment, and dismissed Utah's state law damages claims as well. During the pendency of this litigation, as well as the Dicerna litigation described above, we incurred significant costs, and in each case, the litigation diverted the attention of our management and other resources that would otherwise have been engaged in other activities.

We may need to resort to litigation to enforce a patent issued or licensed to us or to determine the scope and validity of proprietary rights of others or protect our proprietary information and trade secrets. For example, during the second quarter of 2015, we filed a trade secret misappropriation lawsuit against Dicerna to protect our rights in the RNAi assets we purchased from Merck Sharp & Dohme Corp., or Merck. We and Dicerna settled the ongoing litigation between us in April 2018. In March 2022, we announced that we separately filed suit in United States District Court for the District of Delaware against Pfizer and Moderna, Inc., seeking damages for infringement of U.S. Patent No. 11,246,933 in the parties' manufacture and sale of their messenger RNA, or mRNA, COVID-19 vaccines. Pfizer joined BioNTech SE, or BioNTech, to the suit and filed counterclaims. In July 2022, we filed a new lawsuit in United States District Court for the District of Delaware against each of Pfizer/BioNTech and Moderna seeking damages for infringing our newly granted U.S. Patent No. 11,382,979. The Court combined the two patents in a single suit for each of Pfizer/BioNTech and Moderna with trial dates set for each in November

2024. The aforementioned patents relate to our biodegradable cationic lipids that are foundational to the success of the mRNA COVID-19 vaccines.

In protecting our intellectual patent rights through litigation or other means, a third party may claim that we have improperly asserted our rights against them. For example, in August 2017, Dicerna successfully added counterclaims against us in the above-referenced trade secret lawsuit alleging that our lawsuit represented abuse of process and claiming tortious interference with its business. In addition, in August 2017, Dicerna filed a lawsuit against us in the United States District Court of Massachusetts alleging attempted monopolization by us under the Sherman Antitrust Act. As noted above, in April 2018, we and Dicerna settled the ongoing litigation between us.

In addition, in connection with certain license and collaboration agreements, we have agreed to indemnify certain third parties for certain costs incurred in connection with litigation relating to intellectual property rights or the subject matter of the agreements. The cost to us of any litigation or other proceeding relating to intellectual property rights, even if resolved in our favor, could be substantial, and litigation would divert our management's efforts. Some of our competitors may be able to sustain the costs of complex patent litigation more effectively than we can because they have substantially greater resources. Uncertainties resulting from the initiation and continuation of any litigation or legal proceeding could delay our research, development and commercialization efforts and limit our ability to continue our operations.

If any parties successfully claim that our creation or use of proprietary technologies infringes upon or otherwise violates their intellectual property rights, we might be forced to pay damages, potentially including treble damages, if we are found to have willfully infringed on such parties' patent rights. In addition to any damages we might have to pay, a court could issue an injunction requiring us to stop the infringing activity or obtain a license. Any license required under any patent may not be made available on commercially reasonable terms, if at all. In addition, such licenses are likely to be non-exclusive and, therefore, our competitors may have access to the same technology licensed to us. If we fail to obtain a required license and are unable to design around a patent, we may be unable to effectively market some of our technology and products, which could limit our ability to generate revenues or achieve profitability and possibly prevent us from generating revenue sufficient to sustain our operations. Moreover, we expect that a number of our collaborations will provide that royalties payable to us for licenses to our intellectual property may be offset by amounts paid by our collaborators to third parties who have competing or superior intellectual property positions in the relevant fields, which could result in significant reductions in our revenues from products developed through collaborations.

If we fail to comply with our obligations under any licenses or related agreements, we may be required to pay damages and could lose license or other rights that are necessary for developing, commercializing and protecting our RNAi technology, as well as our approved products and any other product candidates that we develop, or we could lose certain rights to grant sublicenses.

Our current licenses impose, and any future licenses we enter into are likely to impose, various development, commercialization, funding, milestone, royalty, diligence, sublicensing, insurance, patent prosecution and enforcement, and other obligations on us. If we breach any of these obligations, or use the intellectual property licensed to us in an unauthorized manner, we may be required to pay damages and the licensor may have the right to terminate the license or render the license non-exclusive, which could result in us being unable to develop, manufacture, market and sell products that are covered by the licensed technology or enable a competitor to gain access to the licensed technology. Moreover, we could incur significant costs and/or disruption to our business and distraction of our management defending against any breach of such licenses alleged by the licensor. For example, in June 2018, Ionis sent us a notice claiming that it was owed payments under our second amended and restated strategic collaboration and license agreement as a result of the January 2018 amendment of our collaboration agreement with Sanofi and the related Exclusive TTR License and AT3 License Terms. Ionis claimed it was owed technology access fees, or TAFs, based on rights granted and amounts paid to us in connection with the Sanofi restructuring. Ionis later filed a Demand for Arbitration with the Boston office of the American Arbitration Association against us, asserting, among other things, breach of contract. Upon completion of the arbitration process in the second quarter of 2020, in October 2020, a partial award was issued by the arbitration panel that sought additional information from us. The arbitration panel issued its final award in December 2020, which ruled in favor of Ionis's request for a TAF on certain rights the panel determined we received in the Sanofi restructuring (but rejecting the TAF amount sought by Ionis), and in favor of us in denying Ionis's request for a TAF on a milestone payment received by us in the same restructuring. The panel's final award also denied Ionis's request for pre-judgement interest and attorney's fees. Pursuant to the panel's final award, we paid $41.2 million to Ionis in January 2021.

Moreover, our licensors may own or control intellectual property that has not been licensed to us and, as a result, we may be subject to claims, regardless of their merit, that we are infringing or otherwise violating the licensor's rights. In addition, while we cannot currently determine the amount of the royalty obligations we will be required to pay on sales of each of our approved products or future products, if any, the amounts may be significant. The amount of our future royalty obligations will depend on the technology and intellectual property we use in such products. Therefore, even if we successfully develop and commercialize products, we may be unable to achieve or maintain profitability.

Confidentiality agreements with employees and others may not adequately prevent disclosure of trade secrets and other proprietary information.

In order to protect our proprietary technology and processes, we rely in part on confidentiality agreements with our collaborators, employees, consultants, CMOs, outside scientific collaborators and sponsored researchers, and other advisors. These agreements may not effectively prevent disclosure of confidential information and may not provide an adequate remedy in the event of unauthorized disclosure of confidential information. In addition, others may independently discover trade secrets and proprietary information, and in such cases we could not assert any trade secret rights against such party. Costly and time-consuming litigation could be necessary to enforce and determine the scope of our proprietary rights, and failure to obtain or maintain trade secret protection could adversely affect our competitive business position.

Risks Related to Competition

The pharmaceutical market is intensely competitive. If we are unable to compete effectively with existing drugs, new treatment methods and new technologies, we may be unable to commercialize successfully any drugs that we develop.

The pharmaceutical market is intensely competitive and rapidly changing. Many large pharmaceutical and biotechnology companies, academic institutions, governmental agencies and other public and private research organizations are pursuing the development of novel drugs for the same diseases that we are targeting or expect to target. Many of our competitors have:

- much greater financial, technical and human resources than we have at every stage of the discovery, development, manufacture and commercialization of products;
- more extensive experience in pre-clinical testing, conducting clinical trials, obtaining regulatory approvals, and in manufacturing, marketing and selling drug products;
- product candidates that are based on previously tested or accepted technologies;
- products that have been approved or are in late stages of development; and
- collaborative arrangements in our target markets with leading companies and research institutions.

We will face intense competition from drugs that have already been approved and accepted by the medical community for the treatment of the conditions for which we may develop drugs. For example, if approved by the FDA, patisiran, our RNAi therapeutic in development for ATTR amyloidosis patients with cardiomyopathy, would compete with tafamidis, marketed by Pfizer, which is currently approved to treat this disease. We also expect to face competition from new drugs that enter the market. There are a number of drugs currently under development, which may become commercially available in the future, for the treatment of conditions for which we may try to develop drugs. These drugs may be more effective, safer, less expensive, or marketed and sold more effectively, than any products we develop and commercialize. For example, we developed ONPATTRO for the treatment of hATTR amyloidosis. In August 2018, the FDA approved ONPATTRO lipid complex injection for the treatment of the polyneuropathy of hATTR amyloidosis in adults, and the EC granted marketing authorization for ONPATTRO for the treatment of hATTR amyloidosis in adults with stage 1 or stage 2 polyneuropathy. We are aware of other approved products used to treat this disease, including tafamidis, and inotersen, developed and marketed by Ionis, as well as product candidates in various stages of clinical development, including eplontersen, an additional investigational drug developed by Ionis in partnership with AstraZeneca, which met co-primary and secondary endpoints in an interim analysis of a Phase 3 study for the polyneuropathy of hATTR amyloidosis, and is currently under regulatory review by the FDA. Finally, we are aware that BridgeBio Pharma, Inc. (formerly Eidos Therapeutics, Inc.), or BridgeBio, announced topline results from Part A of its Phase 3 clinical trial of acoramidis, a TTR stabilizer, in ATTR-CM in December 2021, which did not meet the primary endpoint of the study at month 12. BridgeBio initiated enrollment in Part B of its Phase 3 clinical trial of acoramidis in ATTR-PN patients in the fourth quarter of 2020, and anticipates topline results in mid-2023. While we believe that ONPATTRO has and will continue to have a competitive product profile for the treatment of patients with hATTR amyloidosis with polyneuropathy, and that AMVUTTRA has a competitive product profile in this indication, it is possible that ONPATTRO and/or AMVUTTRA may not compete favorably with these products and product candidates, or others, and, as a result, may not achieve commercial success. Moreover, positive or negative data and/or the commercial success or failure of competitive products could negatively impact our stock price. For example, our stock price was negatively impacted by the results of Part A of BridgeBio's Phase 3 clinical trial.

If we continue to successfully develop product candidates, and obtain approval for them, we will face competition based on many different factors, including:

- the safety and effectiveness of our products relative to alternative therapies, if any;
- the ease with which our products can be administered and the extent to which patients accept relatively new routes of administration;
- the timing and scope of regulatory approvals for these products;
- the availability and cost of manufacturing, marketing and sales capabilities;

- the price of our products relative to alternative approved therapies;
- reimbursement coverage; and
- patent position.

We are aware of product candidates in various stages of clinical development for the treatment of PH1 which would compete with OXLUMO, our RNAi therapeutic approved in the U.S. and EU for the treatment of this disease, including Oxabact®, a bacteria-based investigational therapy in development by OxThera AB, reloxaliase an investigational enzyme therapy in Phase 3 development for primary or severe secondary hyperoxaluria by Allena Pharmaceuticals, Inc., and nedosiran, an investigational RNAi therapeutic in development by Dicerna for the treatment of primary hyperoxaluria. In July 2019, the FDA granted a Breakthrough Therapy Designation to nedosiran for the treatment of patients with primary hyperoxaluria, and in August 2021, Dicerna reported positive topline results from its PHYOX2 pivotal clinical trial of nedosiran for the treatment of primary hyperoxaluria. Based on the results of the trial, Novo Nordisk submitted an NDA to the FDA in September 2022 for the treatment of PH1 in patients aged six years and older. In April 2020, we and Dicerna granted each other a non-exclusive cross-license to our respective intellectual property related to lumasiran, and Dicerna's nedosiran product candidate. Our competitors may develop or commercialize products with significant advantages over any products we develop based on any of the factors listed above or on other factors. In addition, our competitors may develop strategic alliances with or receive funding from larger pharmaceutical or biotechnology companies, providing them with an advantage over us. Our competitors may therefore be more successful in commercializing their products than we are, which could adversely affect our competitive position and business. Competitive products may make any products we develop obsolete or noncompetitive before we can recover the expenses of developing and commercializing our product candidates. Such competitors could also recruit our employees, which could negatively impact our level of expertise and the ability to execute on our business plan. Furthermore, we also face competition from existing and new treatment methods that reduce or eliminate the need for drugs, such as the use of advanced medical devices. The development of new medical devices or other treatment methods for the diseases we are targeting could make our product candidates noncompetitive, obsolete or uneconomical.

We face competition from other companies that are working to develop novel drugs and technology platforms using technology similar to ours. If these companies develop drugs more rapidly than we do or their technologies, including delivery technologies, are more effective, our ability to successfully commercialize drugs may be adversely affected.

In addition to the competition we face from competing drugs in general, we also face competition from other companies working to develop novel drugs using technology that competes more directly with our own. We are aware of several other companies that are working to develop RNAi therapeutic products. Some of these companies are seeking, as we are, to develop chemically synthesized siRNAs as drugs. Others are following a gene therapy approach, with the goal of treating patients not with synthetic siRNAs but with synthetic, exogenously-introduced genes designed to produce siRNA-like molecules within cells. Companies working on chemically synthesized siRNAs include, but are not limited to, Takeda, Marina, Arrowhead, Quark, Silence, Arbutus, Sylentis, Dicerna and its collaborators, WAVE, Arcturus, and Genevant Sciences, launched by Arbutus and Roivant Sciences. In addition, we granted licenses or options for licenses to Ionis, Benitec, Arrowhead, Arbutus, Quark, Sylentis and others under which these companies may independently develop RNAi therapeutics against a limited number of targets. Any one of these companies may develop its RNAi technology more rapidly and more effectively than us.

In addition, as a result of agreements that we have entered into, Takeda has obtained a non-exclusive license, and Arrowhead, as the assignee of Novartis, has obtained specific exclusive licenses for 30 gene targets, that include access to certain aspects of our technology. We also compete with companies working to develop antisense-based drugs. Like RNAi therapeutics, antisense drugs target mRNAs in order to suppress the activity of specific genes. Akcea (acquired by Ionis in October 2020), has received marketing approval for an antisense drug, inotersen that was developed by Ionis, for the treatment of stage 1 or stage 2 polyneuropathy in adult patients with hATTR amyloidosis. Several antisense drugs developed by Ionis have been approved and are currently marketed, and Ionis has multiple antisense product candidates in clinical trials. Ionis is also developing antisense drugs using ligand-conjugated GalNAc technology licensed from us, and these drugs have been shown to have increased potency at lower doses in clinical and pre-clinical studies, compared with antisense drugs that do not use such licensed GalNAc technology. The development of antisense drugs and antisense technology may become the preferred technology for drugs that target mRNAs to silence specific genes.

In addition to competition with respect to RNAi and with respect to specific products, we face substantial competition to discover and develop safe and effective means to deliver siRNAs to the relevant cell and tissue types. Safe and effective means to deliver siRNAs to the relevant cell and tissue types may be developed by our competitors, and our ability to successfully commercialize a competitive product would be adversely affected. In addition, substantial resources are being expended by third parties in the effort to discover and develop a safe and effective means of delivering siRNAs into the relevant cell and tissue types, both in academic laboratories and in the corporate sector. Some of our competitors have substantially greater resources than we do, and if our competitors are able to negotiate exclusive access to those delivery solutions developed by third parties, we may be unable to successfully commercialize our product candidates.

Risks Related to Our Common Stock

If our stock price fluctuates, purchasers of our common stock could incur substantial losses.

The market price of our common stock has fluctuated significantly and may continue to fluctuate significantly in response to factors that are beyond our control. The stock market in general has from time to time experienced extreme price and volume fluctuations, and the biotechnology sector in particular has experienced extreme price and volume fluctuations. The market prices of securities of pharmaceutical and biotechnology companies have been extremely volatile, and have experienced fluctuations that often have been unrelated or disproportionate to the clinical development progress or operating performance of these companies, including as a result of adverse development events reported by other companies. For example, the trading price for our common stock and the common stock of other biopharmaceutical companies was highly volatile during the initial stages of the COVID-19 pandemic. These broad market and sector fluctuations have resulted and could in the future result in extreme fluctuations in the price of our common stock, which could cause purchasers of our common stock to incur substantial losses.

We may incur significant costs from class action litigation.

Our stock price may fluctuate for many reasons, including as a result of public announcements regarding the progress of our development and commercialization efforts or the development and commercialization efforts of our collaborators and/or competitors, the addition or departure of our key personnel, variations in our quarterly operating results and changes in market valuations of pharmaceutical and biotechnology companies. When the market price of a stock has been volatile as our stock price has been, holders of that stock have occasionally brought securities class action litigation against the company that issued the stock.

For example, on September 12, 2019, the Chester County Employees Retirement Fund, individually and on behalf of all others similarly situated, filed a purported securities class action complaint alleging violation of federal securities laws against us, certain of our current and former directors and officers, and the underwriters of our November 14, 2017 public stock offering, in the Supreme Court of the State of New York, New York County. While we believe the allegations in the New York State Securities Litigation were without merit, in August 2021, the parties reached an agreement in principle to resolve the matter. At a hearing on April 12, 2022, the Supreme Court of the State of New York granted final approval to the settlement. Proceedings in the First Department were adjourned until April 2022, pending final approval of any settlement, and were withdrawn as a result of final approval on April 18, 2022. Future litigation could result in substantial costs and divert our management's attention and resources, which could cause serious harm to our business, operating results and financial condition. We maintain liability insurance; however, if any costs or expenses associated with litigation exceed our insurance coverage, we may be forced to bear some or all of these costs and expenses directly, which could be substantial. In addition, we have obligations to indemnify third parties in connection with certain litigation, and such obligations are not covered by insurance.

Future sales of shares of our common stock, including by our significant stockholders, us or our directors and officers, could cause the price of our common stock to decline.

A small number of our stockholders beneficially own a substantial amount of our common stock. As of January 31, 2023, our six largest stockholders beneficially owned in excess of 50% of our outstanding shares of common stock. If our significant stockholders, or we or our officers and directors, sell substantial amounts of our common stock in the public market, or there is a perception that such sales may occur, the market price of our common stock could be adversely affected. Sales of common stock by our significant stockholders might make it more difficult for us to raise funds by selling equity or equity-related securities in the future at a time and price that we deem appropriate.

Regeneron's ownership of our common stock could delay or prevent a change in corporate control.

As of May 21, 2019, the closing date of the stock purchase in connection with the 2019 Regeneron collaboration, Regeneron held approximately 4% of our outstanding common stock and has the right to increase its ownership up to 30%. This concentration of ownership could harm the market price of our common stock in the future by:

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

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

Provisions in our certificate of incorporation and our bylaws may delay or prevent an acquisition of us or a change in our management. In addition, these provisions may frustrate or prevent any attempts by our stockholders to replace or remove our current management by making it more difficult for stockholders to replace members of our board of directors. Because our

board of directors is responsible for appointing the members of our management team, these provisions could in turn affect any attempt by our stockholders to replace current members of our management team. These provisions include:

- a classified board of directors;
- a prohibition on actions by our stockholders by written consent;
- limitations on the removal of directors; and
- advance notice requirements for election to our board of directors and for proposing matters that can be acted upon at stockholder meetings.

In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which prohibits a person who owns in excess of 15% of our outstanding voting stock from merging or combining with us for a period of three years after the date of the transaction in which the person acquired in excess of 15% of our outstanding voting stock, unless the merger or combination is approved in a prescribed manner. These provisions would apply even if the proposed merger or acquisition could be considered beneficial by some stockholders.

Risks Related to Our Convertible Notes

Servicing our debt may require a significant amount of cash. We may not have sufficient cash flow from our business to pay our indebtedness.

On September 12, 2022, we commenced a private offering of $900.0 million in aggregate principal amount of 1% Convertible Senior Notes due 2027, or the Initial Notes. On September 13, 2022, the initial purchasers in such offering exercised their option to purchase an additional $135.0 million in aggregate principal amount of our 1% Convertible Senior Notes due 2027, or the Additional Notes, and together with the Initial Notes, collectively referred to as the Notes, bringing the total aggregate principal amount of the Notes to $1.04 billion. The interest rate for the Notes is fixed at 1.00% per annum and is payable semi-annually in arrears on May 15 and September 15 of each year, beginning on March 15, 2023. Our ability to make scheduled payments of the principal of, to pay interest on or to refinance our indebtedness, including the Notes, or to make cash payments in connection with any conversions of Notes, depends on our future performance, which is subject to economic, financial, competitive and other factors beyond our control. Our business may not generate cash flow from operations in the future sufficient to service our debt and make necessary capital expenditures. If we are unable to generate such cash flow, we may be required to adopt one or more alternatives, such as selling assets, restructuring debt or obtaining additional debt financing or equity capital on terms that may be onerous or highly dilutive. Our ability to refinance any future indebtedness will depend on the capital markets and our financial condition at such time. We may not be able to engage in any of these activities or engage in these activities on desirable terms, which could result in a default on our debt obligations. In addition, any of our future debt agreements may contain restrictive covenants that may prohibit us from adopting any of these alternatives. Our failure to comply with these covenants could result in an event of default which, if not cured or waived, could result in the acceleration of our debt.

We may not have the ability to raise the funds necessary to settle for cash conversions of the Notes or to repurchase the Notes for cash upon a fundamental change, and our future debt may contain limitations on our ability to pay cash upon conversion of the Notes or to repurchase the Notes.

Holders of the Notes have the right to require us to repurchase their Notes upon the occurrence of a fundamental change (as defined in the indenture governing the Notes) at a repurchase price equal to 100% of the principal amount of the Notes to be repurchased, plus accrued and unpaid interest, if any. Upon conversion of the Notes, unless we elect to deliver solely shares of our common stock to settle such conversion (other than paying cash in lieu of delivering any fractional share), we will be required to make cash payments in respect of the Notes being converted. We may not have enough available cash or be able to obtain financing at the time we are required to make repurchases of Notes surrendered or Notes being converted. In addition, our ability to repurchase the Notes or to pay cash upon conversions of the Notes may be limited by law, by regulatory authority or by agreements governing our future indebtedness. Our failure to repurchase Notes at a time when the repurchase is required by the indenture governing such notes or to pay any cash payable on future conversions of the Notes as required by such indenture would constitute a default under such indenture. A default under the indenture governing the Notes or the fundamental change itself could also lead to a default under agreements governing our future indebtedness. If the repayment of the related indebtedness were to be accelerated after any applicable notice or grace periods, we may not have sufficient funds to repay the indebtedness and repurchase the Notes or make cash payments upon conversions.

In addition, our indebtedness, combined with our other financial obligations and contractual commitments, could have other important consequences. For example, it could:

- make us more vulnerable to adverse changes in general U.S. and worldwide economic, industry and competitive conditions and adverse changes in government regulation;
- limit our flexibility in planning for, or reacting to, changes in our business and our industry;
- place us at a disadvantage compared to our competitors who have less debt;

- limit our ability to borrow additional amounts to fund acquisitions, for working capital and for other general corporate purposes; and
- make an acquisition of our company less attractive or more difficult.

Any of these factors could harm our business, results of operations and financial condition. In addition, if we incur additional indebtedness, the risks related to our business and our ability to service or repay our indebtedness would increase.

The conditional conversion feature of the Notes, if triggered, may adversely affect our financial condition and operating results.

In the event the conditional conversion feature of the Notes is triggered, holders of the Notes will be entitled to convert the Notes at any time during specified periods at their option. If one or more holders elect to convert their Notes, unless we elect to satisfy our conversion obligation by delivering solely shares of our common stock (other than paying cash in lieu of delivering any fractional share), we would be required to settle a portion or all of our conversion obligation through the payment of cash, which could adversely affect our liquidity. In addition, even if holders do not elect to convert their Notes, we could be required under applicable accounting rules to reclassify all or a portion of the outstanding principal of the Notes as a current rather than long-term liability, which would result in a material reduction of our net working capital.

Transactions relating to our Notes may affect the value of our common stock.

The conversion of some or all of the Notes would dilute the ownership interests of existing stockholders to the extent we satisfy our conversion obligation by delivering shares of our common stock upon any conversion of such Notes. Our Notes may become in the future convertible at the option of their holders under certain circumstances. If holders of our Notes elect to convert their notes, we may settle our conversion obligation by delivering to them a significant number of shares of our common stock, which would cause dilution to our existing stockholders.

In addition, in connection with the issuance of the Notes, we entered into the Capped Calls with certain financial institutions, or the Option Counterparties. The Capped Calls are generally expected to reduce potential dilution to our common stock upon any conversion or settlement of the Notes and/or offset any cash payments we are required to make in excess of the principal amount of converted Notes, with such reduction and/or offset subject to a cap.

In connection with establishing their initial hedges of the Capped Calls, the Option Counterparties or their respective affiliates entered into various derivative transactions with respect to our common stock and/or purchased shares of our common stock concurrently with or shortly after the pricing of the Notes.

From time to time, the Option Counterparties or their respective affiliates may modify their hedge positions by entering into or unwinding various derivative transactions with respect to our common stock and/or purchasing or selling our common stock or other securities of ours in secondary market transactions prior to the maturity of the Notes (and are likely to do so following any conversion of the Notes, any repurchase of the Notes by us on any fundamental change repurchase date, any redemption date, or any other date on which the Notes are retired by us, in each case, if we exercise our option to terminate the relevant portion of the Capped Calls). This activity could cause a decrease and/or increased volatility in the market price of our common stock.

We do not make any representation or prediction as to the direction or magnitude of any potential effect that the transactions described above may have on the price of the Notes or our common stock. In addition, we do not make any representation that the Option Counterparties will engage in these transactions or that these transactions, once commenced, will not be discontinued without notice.

We are subject to counterparty risk with respect to the Capped Calls.

The Option Counterparties are financial institutions, and we will be subject to the risk that any or all of them might default under the Capped Calls. Our exposure to the credit risk of the Option Counterparties will not be secured by any collateral. Past global economic conditions have resulted in the actual or perceived failure or financial difficulties of many financial institutions. If an Option Counterparty becomes subject to insolvency proceedings, we will become an unsecured creditor in those proceedings with a claim equal to our exposure at that time under the Capped Calls with such Option Counterparty. Our exposure will depend on many factors but, generally, an increase in our exposure will be correlated to an increase in the market price and in the volatility of our common stock. In addition, upon a default by an Option Counterparty, we may suffer adverse tax consequences and more dilution than we currently anticipate with respect to our common stock. We can provide no assurances as to the financial stability or viability of the Option Counterparties.

The accounting method for convertible debt securities that may be settled in cash, such as the Notes, could have a material effect on our reported financial results.

The accounting method for reflecting the Notes on our consolidated balance sheet, accruing interest expense for the Notes and reflecting the underlying shares of our common stock in our reported diluted earnings per share may adversely affect our reported earnings and financial condition.

In August 2020, the Financial Accounting Standards Board published an Accounting Standards Update, which we refer to as ASU 2020-06, which simplified certain of the accounting standards that apply to convertible notes. ASU 2020-06 became effective for us beginning January 1, 2022.

In accordance with ASU 2020-06, the Notes will be reflected as a liability on our consolidated balance sheets, with the initial carrying amount equal to the principal amount of the Notes, net of issuance costs. The issuance costs will be treated as a debt discount for accounting purposes, which will be amortized into interest expense over the term of the Notes. As a result of this amortization, the interest expense that we expect to recognize for the Notes for accounting purposes will be greater than the cash interest payments we will pay on the Notes, which will result in lower reported net income or higher reported net loss, as the case may be.

In addition, we expect that the shares of common stock underlying the Notes will be reflected in our diluted earnings per share using the "if converted" method, in accordance with ASU 2020-06. Under that method, diluted earnings per share would generally be calculated assuming that all the Notes were converted solely into shares of common stock at the beginning of the reporting period, unless the result would be anti-dilutive. The application of the if-converted method may reduce our reported diluted earnings per share to the extent we are profitable in the future, and accounting standards may change in the future in a manner that may adversely affect our diluted earnings per share.

Furthermore, if any of the conditions to the convertibility of the Notes is satisfied, then we may be required under applicable accounting standards to reclassify the liability carrying value of the Notes as a current, rather than a long-term, liability. This reclassification could be required even if no holders convert their notes and could materially reduce our reported working capital.

ITEM 1B. UNRESOLVED STAFF COMMENTS

Not applicable.

ITEM 2. PROPERTIES

Our operations are based primarily in Cambridge, Massachusetts; Zug, Switzerland; Maidenhead, United Kingdom; Amsterdam, Netherlands; and Tokyo, Japan. A description of certain of the facilities we lease or own as of January 31, 2023 is included in the table below.

Location	Primary Use	Approximate Square Footage	Lease Expiration Date	Renewal Option
675 West Kendall Street Henri A. Termeer Square Cambridge, Massachusetts	Corporate headquarters and primary research facility	295,000	January 2034	Two five-year terms
300 Third Street Cambridge, Massachusetts	Office space and additional research facility	129,000	January 2034	Two five-year terms
101 Main Street Cambridge, Massachusetts	Office space*	61,000	March 2024 and June 2026	One five-year term on each lease
20 Commerce Way Norton, Massachusetts	cGMP manufacturing	200,000	Not applicable	Not applicable
665 Concord Avenue Cambridge, Massachusetts	cGMP manufacturing**	15,000	September 2027	One five-year term
Grafenauweg 4 6300 Zug, Switzerland	International headquarters	14,500	March 2028	One five-year term
Braywick Gate Braywick Road, Maidenhead Berkshire, United Kingdom	Office space	21,500	May 2026	None
Wisdom Cross Tower Antonio Vivaldistraat 150 Amsterdam, Netherlands	Office space	12,500	April 2025	One five-year term
Pacific Century Place 1-Chome-11-1 Marunouchi Chiyoda-ku Tokyo, Japan	Office space	16,900	May 2025	None

* We lease office space located on the 12th and 13th floors at 101 Main Street, Cambridge, Massachusetts under a non-cancelable real property lease agreement by and between the Company and RREEF America REIT II CORP. PPP, dated as of April 15, 2015, or the Lease. On September 30, 2020, we entered into a First Amendment to the Lease, pursuant to which the term of the Lease with respect to the 12th and 13th floors was extended for an additional five years, through June 30, 2026. In addition, we have a separate lease agreement for the 10th floor at 101 Main Street, which expires in March 2024.

** We manufacture ONPATTRO (patisiran) formulated bulk drug product at this location.

In addition to the locations above, we also occupy small offices in multiple locations in and outside of the U.S. to support our operations and growth.

In the future, we may lease, operate, purchase or construct additional facilities in which to conduct expanded research, development and manufacturing activities and support future commercial operations. We believe that the total space available to us under our current leases will meet our needs for the foreseeable future and that additional space would be available to us on commercially reasonable terms if required.

ITEM 3. LEGAL PROCEEDINGS

For a discussion of material pending legal proceedings, please read the section titled "Litigation" within Note 14, Commitments and Contingencies, to our consolidated financial statements included in Part II, Item 8, “Financial Statements and Supplementary Data,” of this Annual Report on Form 10-K, which is incorporated into this item by reference.

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 trades on The Nasdaq Global Select Market under the symbol "ALNY."

Holders of Record

At January 31, 2023, there were 24 holders of record of our common stock. Because many of our shares are held by brokers and other institutions on behalf of stockholders, we are unable to estimate the total number of beneficial holders represented by these record holders.

Issuer Purchases of Equity Securities

The following table provides information about our purchases of shares of Alnylam common stock during the three-month period ended December 31, 2022:

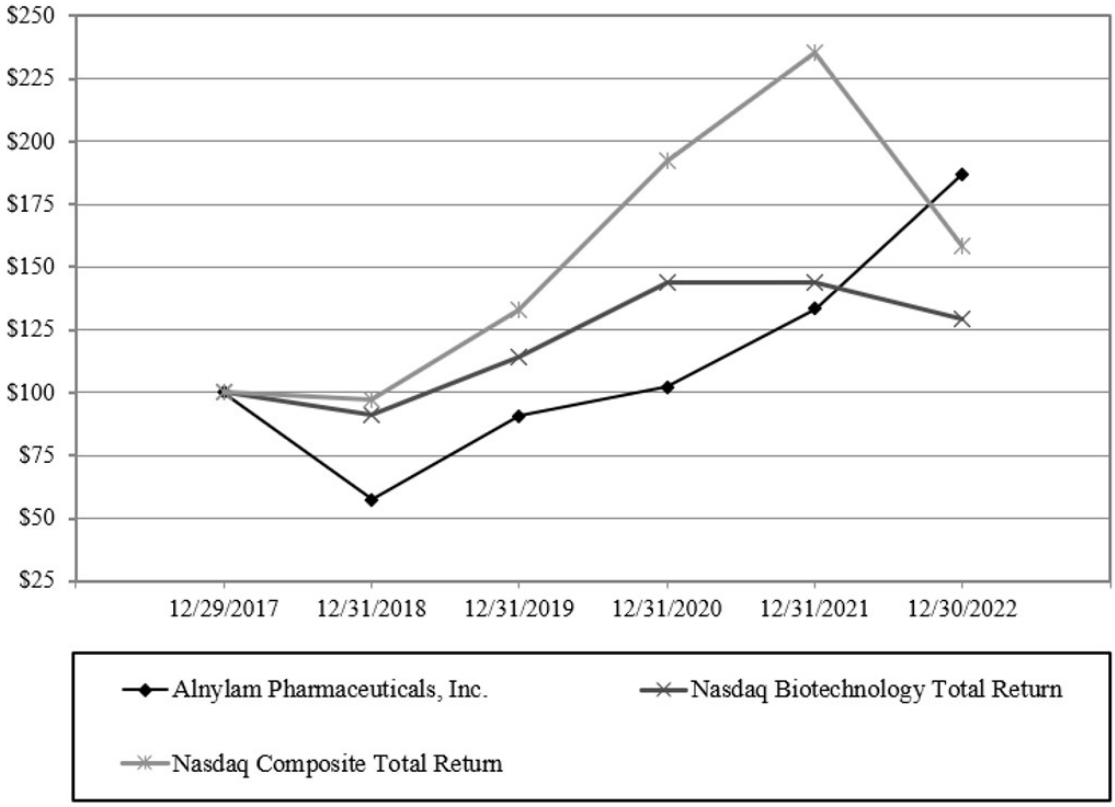
Period	Total Number of Shares Purchased (1)	Average Price per Share	Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs	Maximum Number (or Approximated Dollar Value) of Shares that May Yet Be Purchased Under the Plans or Programs
October 1, 2022 - October 31, 2022	—	$ —	—	—
November 1, 2022 - November 30, 2022	—	—	—	—
December 1, 2022 - December 31, 2022	3,182	231.84	—	—
Total	3,182	$ 231.84	—	—

(1) Share repurchases reported in this column consist of shares of Alnylam's common stock tendered by employees in December 2022 to cover the exercise price of certain stock options exercised by those employees.

Stock Performance Graph

The following performance graph and related information shall not be deemed "soliciting material" or to be "filed" with the SEC, nor shall such information be incorporated by reference into any future filing under the Securities Act of 1933 or Securities Exchange Act of 1934, each as amended, except to the extent that we specifically incorporate it by reference into such filing.

The comparative stock performance graph below compares the five-year cumulative total stockholder return (assuming reinvestment of dividends, if any) from investing $100 on the last trading day of 2017, to the close of the last trading day of 2022, in each of our common stock and the selected indices. The stock price performance reflected in the graph below is not necessarily indicative of future price performance.



Comparison of Five-Year Cumulative Total Return
Among Alnylam Pharmaceuticals, Inc.,
Nasdaq Composite Total Return and Nasdaq Biotechnology Total Return

	12/29/2017	12/31/2018	12/31/2019	12/31/2020	12/31/2021	12/30/2022
Alnylam Pharmaceuticals, Inc.	$ 100.00	$ 57.39	$ 90.65	$ 102.30	$ 133.48	$ 187.05
Nasdaq Composite Total Return	$ 100.00	$ 97.16	$ 132.81	$ 192.47	$ 235.15	$ 158.65
Nasdaq Biotechnology Total Return	$ 100.00	$ 91.14	$ 114.02	$ 144.15	$ 144.18	$ 129.59

ITEM 6. RESERVED

Not applicable.

ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

Overview

We are a global commercial-stage biopharmaceutical company that discovers, develops, manufactures and commercializes novel therapeutics based on RNAi. Our commercial products and broad pipeline of investigational RNAi therapeutics are focused in four STArs: Genetic Medicines, Cardio-Metabolic Diseases, Hepatic Infectious Diseases and CNS/Ocular Diseases.

As described in Part I, Item 1. "Business," of this Annual Report on Form 10-K, we currently have five products that have received marketing approval, including one partnered product, and multiple late-stage investigational programs advancing towards potential commercialization. In Part I, Item 1. "Business" you can also find a summary of key events in 2022 and 2023 to-date related to our marketed products and our clinical development programs.

We have incurred significant losses since we commenced operations in 2002 and as of December 31, 2022, we had an accumulated deficit of $6.57 billion. Historically, we have generated losses principally from costs associated with research and development activities, acquiring, filing and expanding intellectual property rights, and selling, general and administrative costs. As a result of planned expenditures for research and development activities relating to our research platform, our drug development programs, including clinical trial and manufacturing costs, the establishment of late-stage clinical and commercial capabilities, including global commercial operations, continued management and growth of our patent portfolio, collaborations and general corporate activities, we expect to incur additional operating losses, however we expect 2019 represents our peak operating loss year as we transition towards a self-sustainable financial profile. We anticipate that our operating results will continue to fluctuate for the foreseeable future. Therefore, period-to-period comparisons should not be relied upon as predictive of the results in future periods.

We currently have programs focused on a number of therapeutic areas and, as of December 31, 2022, we generate worldwide product revenues from four commercialized products, ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO, primarily in the U.S., Europe and Japan. However, our ongoing development efforts may not be successful and we may not be able to commence sales of any other products and/or successfully market and sell ONPATTRO, AMVUTTRA, GIVLAARI, OXLUMO or any other approved products in the future. A substantial portion of our total revenues in recent years has been derived from collaboration revenues from strategic alliances with Regeneron, Vir and Novartis. In addition to revenues from the commercial sales of our approved products and potentially from sales of future products, we expect our sources of potential funding for the next several years to continue to be derived in part from existing and new strategic alliances. Such alliances include, or may include in the future, license and other fees, funded research and development, milestone payments and royalties on product sales by our licensors, including royalties on sales of Leqvio made by our partner Novartis, as well as proceeds from the sale of equity or debt.

Results of Operations

The following data summarizes the results of our operations:

	Year Ended December 31,			2022 vs 2021		2021 vs 2020	
(In thousands, except percentages)	2022	2021	2020	$ Change	% Change	$ Change	% Change
Total revenues	$ 1,037,418	$ 844,287	$ 492,853	$ 193,131	23 %	$ 351,434	71 %
Operating costs and expenses	$ 1,822,490	$ 1,552,939	$ 1,321,291	$ 269,551	17 %	$ 231,648	18 %
Loss from operations	$ (785,072)	$ (708,652)	$ (828,438)	$ (76,420)	11 %	$ 119,786	(14)%
Net loss	$ (1,131,156)	$ (852,824)	$ (858,281)	$ (278,332)	33 %	$ 5,457	(1)%

For discussion of our 2021 results and a comparison with 2020 results please refer to "Management's Discussion and Analysis of Financial Conditions and Results of Operations" in our Annual Report on Form 10-K for the fiscal year ended December 31, 2021 that was filed with the SEC on February 10, 2022.

Discussion of Results of Operations

Revenues

Total revenues consist of the following:

	Years Ended December 31,			2022 vs 2021		2021 vs 2020	
(In thousands, except percentages)	2022	2021	2020	$ Change	% Change	$ Change	% Change
Net product revenues	$ 894,329	$ 662,138	$ 361,520	$ 232,191	35 %	$ 300,618	83 %
Net revenues from collaborations	134,912	180,953	131,333	(46,041)	(25)%	49,620	38 %
Royalty revenue	8,177	1,196	—	6,981	584 %	1,196	N/A
Total	$ 1,037,418	$ 844,287	$ 492,853	$ 193,131	23 %	$ 351,434	71 %

Net Product Revenues

Net product revenues consist of the following, by product and region:

(In thousands, except percentages)	Year Ended December 31, 2022	2021	2020	2022 vs 2021 $ Change	2022 vs 2021 % Change	2021 vs 2020 $ Change	2021 vs 2020 % Change
ONPATTRO							
United States	$ 246,748	$ 213,210	$ 151,574	$ 33,538	16 %	$ 61,636	41 %
Europe	224,063	190,435	107,755	33,628	18 %	82,680	77 %
Rest of World	86,797	71,092	46,752	15,705	22 %	24,340	52 %
Total	557,608	474,737	306,081	82,871	17 %	168,656	55 %
AMVUTTRA							
United States	82,521	—	—	82,521	N/A	—	N/A
Europe	4,214	—	—	4,214	N/A	—	N/A
Rest of World	7,060	—	—	7,060	N/A	—	N/A
Total	93,795	—	—	93,795	N/A	—	N/A
GIVLAARI							
United States	115,659	92,747	42,797	22,912	25 %	49,950	117 %
Europe	48,670	30,895	12,000	17,775	58 %	18,895	157 %
Rest of World	8,815	4,173	309	4,642	111 %	3,864	1,250 %
Total	173,144	127,815	55,106	45,329	35 %	72,709	132 %
OXLUMO							
United States	27,698	18,876	—	8,822	47 %	18,876	N/A
Europe	37,915	38,949	333	(1,034)	(3)%	38,616	11,596 %
Rest of World	4,169	1,761	—	2,408	137 %	1,761	N/A
Total	69,782	59,586	333	10,196	17 %	59,253	17,794 %
Total net product revenues	$ 894,329	$ 662,138	$ 361,520	$ 232,191	35 %	$ 300,618	83 %

Net product revenues increased during the year ended December 31, 2022, compared to the year ended December 31, 2021, primarily as a result of increased patients across our commercial portfolio of products, including the initial launch of AMVUTTRA.

We expect net product revenues to increase during 2023, as compared to 2022, as we continue to add new patients onto our commercial products, as well as launch these products into additional markets, assuming regulatory approvals.

Please read Note 3 to our consolidated financial statements included in Part II, Item 8, "Financial Statements and Supplementary Data," of this Annual Report on Form 10-K for balances and activity in each product revenue allowance and reserve category for the years ended December 31, 2022 and 2021.

Net Revenues from Collaborations and Royalty Revenue

Net revenues from collaborations consist of the following:

(In thousands, except percentages)	Years Ended December 31, 2022	2021	2020	2022 vs 2021 $ Change	2022 vs 2021 % Change	2021 vs 2020 $ Change	2021 vs 2020 % Change
Regeneron Pharmaceuticals	$ 87,844	$ 113,226	$ 74,072	$ (25,382)	(22)%	$ 39,154	53 %
Novartis AG	43,159	49,120	22,208	(5,961)	(12)%	26,912	121 %
Vir Biotechnology	1,755	16,897	31,396	(15,142)	(90)%	(14,499)	(46)%
Other	2,154	1,710	3,657	444	26 %	(1,947)	(53)%
Total	$ 134,912	$ 180,953	$ 131,333	$ (46,041)	(25)%	$ 49,620	38 %

Net revenues from collaborations decreased during the year ended December 31, 2022, as compared to the year ended December 31, 2021, primarily due to a decrease in revenue recognized in connection with our collaboration agreements with Regeneron and Vir, attributed to reduced research and manufacturing activities and timing of reimbursable activities.

Royalty revenue increased during the year ended December 31, 2022, as compared to the year ended December 31, 2021, primarily due to increased global net sales of Leqvio by our partner, Novartis. In December 2020, Leqvio received marketing authorization from the EC for the treatment of adults with hypercholesterolemia or mixed dyslipidemia, and in December 2021, Leqvio was approved by the FDA for the treatment of adults with HeFH or ASCVD.

Recognition of our combined net revenues from collaborations and royalty revenue is dependent on a variety of factors including the level of work reimbursed by partners, achievement of milestones under our collaboration agreements, and royalties associated with sales of Leqvio. We expect variability in net revenues from collaboration and royalty revenue in 2023, as compared to 2022, due to the timing of manufacturing activities, achievement of milestones under our collaboration agreements and royalties associated with sales of Leqvio.

Operating Costs and Expenses

Operating costs and expenses consist of the following:

	Year Ended December 31,			2022 vs 2021		2021 vs 2020	
(In thousands, except percentages)	**2022**	**2021**	**2020**	**$ Change**	**% Change**	**$ Change**	**% Change**
Cost of goods sold	$ 140,174	$ 115,005	$ 74,185	$ 25,169	22 %	$ 40,820	55 %
Cost of goods sold as a percentage of net product revenues	*15.7 %*	*17.4 %*	*20.5 %*				
Cost of collaborations and royalties	28,643	25,139	3,867	3,504	14 %	21,272	550 %
Research and development	883,015	792,156	654,819	90,859	11 %	137,337	21 %
Selling, general and administrative	770,658	620,639	588,420	150,019	24 %	32,219	5 %
Total	$ 1,822,490	$ 1,552,939	$ 1,321,291	$ 269,551	17 %	$ 231,648	18 %

Cost of Goods Sold

Cost of goods sold as a percentage of net product revenues decreased to 15.7% for the year ended December 31, 2022, as compared to 17.4% for the year ended December 31, 2021, primarily due to an increase in sales of products with a lower cost to manufacture.

We anticipate variability in our cost of goods sold as a percentage of net product revenues due to the timing of manufacturing runs and utilization and the depletion of zero-cost inventories, as well as future product launches. We expect cost of goods sold will increase during 2023, as compared to 2022, primarily as a result of an expected increase in net product sales as well as increased royalties.

Cost of collaborations and royalties

Cost of collaborations and royalties increased during the year ended December 31, 2022, as compared to the year ended December 31, 2021, primarily due to timing and demand of GalNAc material supply to our collaboration partners to support certain product manufacturing and ongoing clinical trials.

We anticipate variability in the cost of collaborations and royalties during 2023, as compared to 2022, due to the timing and demand of GalNAc material to be supplied to our collaboration partners.

Research and Development

Research and development expenses consist of the following:

	Year Ended December 31,			2022 vs 2021		2021 vs 2020	
(In thousands, except percentages)	**2022**	**2021**	**2020**	**$ Change**	**% Change**	**$ Change**	**% Change**
Clinical research and outside services	$ 438,418	$ 418,985	$ 307,378	$ 19,433	5 %	$ 111,607	36 %
Compensation and related	225,589	196,134	190,705	29,455	15 %	5,429	3 %
Occupancy and all other costs	126,847	108,622	96,272	18,225	17 %	12,350	13 %
Stock-based compensation	92,161	68,415	60,464	23,746	35 %	7,951	13 %
Total	$ 883,015	$ 792,156	$ 654,819	$ 90,859	11 %	$ 137,337	21 %

Research and development expenses increased during the year ended December 31, 2022, as compared to the year ended December 31, 2021, primarily due to the following:

- Increased compensation and related expenses as a result of increased headcount to support our R&D pipeline and development expenses;
- Increased stock-based compensation expense primarily due to the accounting for certain performance-based awards; and
- Increased clinical research and outside services expenses primarily due to increase in clinical batches manufactured and development expenses associated with the KARDIA-1 and KARDIA-2 zilebesiran phase 2 studies.

During the years ended December 31, 2022 and 2021, in connection with advancing activities under our collaboration agreements, we incurred research and development expenses, primarily related to external development and clinical expenses, including the manufacture of clinical product.

The following table summarizes research and development expenses incurred, for which we recognize net revenue, that are directly attributable to our collaboration agreements, by collaboration partner:

	Year Ended December 31,		
(In thousands)	2022	2021	2020
Regeneron Pharmaceuticals	$ 43,002	$ 73,411	$ 57,833
Other	1,172	15,575	35,300
Total	$ 44,174	$ 88,986	$ 93,133

Selling, General and Administrative

Selling, general and administrative expenses consist of the following:

	Year Ended December 31,			2022 vs 2021		2021 vs 2020	
(In thousands, except percentages)	2022	2021	2020	$ Change	% Change	$ Change	% Change
Compensation and related	$ 273,262	$ 224,237	$ 200,071	$ 49,025	22 %	$ 24,166	12 %
Consulting and professional services	226,941	201,841	176,097	25,100	12 %	25,744	15 %
Stock-based compensation	138,488	97,302	79,409	41,186	42 %	17,893	23 %
Occupancy and all other costs	131,967	97,259	132,843	34,708	36 %	(35,584)	(27)%
Total	$ 770,658	$ 620,639	$ 588,420	$ 150,019	24 %	$ 32,219	5 %

Selling, general and administrative expenses increased during the year ended December 31, 2022, as compared to the year ended December 31, 2021, primarily due to the following:

- Increased compensation and related expenses as a result of increased headcount and other strategic investments in support of the global launch of AMVUTTRA and other expenses to support our strategic growth;
- Increased stock-based compensation expense primarily due to the accounting for certain performance-based awards; and
- Increased consulting and professional services expenses to support our commercial portfolio.

We expect that research and development expenses combined with selling, general and administrative expenses will increase during 2023, as compared to 2022, as we continue to advance and develop our platform and pipeline, advance our product candidates, including partnered programs, into later-stage development, prepare regulatory submissions and continue to build-out our global commercial and compliance infrastructure and field team to support ONPATTRO, GIVLAARI, OXLUMO, and the launch of AMVUTTRA in the U.S. and EU, as well as launch these products into additional markets, assuming regulatory approvals. However, we expect that certain expenses will be variable depending on the timing of manufacturing batches, clinical trial enrollment and results, regulatory review of our product candidates and programs, and stock-based compensation expenses due to our determination regarding the probability of vesting for performance-based awards.

Other (Expense) Income

Other (expense) income consists of the following:

(In thousands, except percentages)	Year Ended December 31, 2022	2021	2020	2022 vs 2021 $ Change	2022 vs 2021 % Change	2021 vs 2020 $ Change	2021 vs 2020 % Change
Interest expense	$ (155,968)	$ (143,021)	$ (84,496)	$ (12,947)	9 %	$ (58,525)	69 %
Other (expense) income, net							
Interest income	24,808	1,579	11,809	23,229	1,471 %	(10,230)	(87)%
Realized and unrealized (losses) gains on marketable equity securities	(33,312)	55,695	54,042	(89,007)	(160)%	1,653	3 %
Change in fair value of development derivative liability	(94,659)	(38,433)	(17,185)	(56,226)	146 %	(21,248)	124 %
Other	(6,204)	(19,312)	8,668	13,108	(68)%	(27,980)	(323)%
Loss on the extinguishment of debt	(76,586)	—	—	(76,586)	N/A	—	N/A
Total	$ (341,921)	$ (143,492)	$ (27,162)	$ (198,429)	138 %	$ (116,330)	428 %

Total other expense increased during the year ended December 31, 2022, as compared to the year ended December 31, 2021, primarily due to a $76.6 million loss on the extinguishment of the Blackstone credit agreement, increased realized and unrealized losses on our marketable equity securities holdings, and increased loss as a result of a mark-to-market adjustment related to the development derivative liability.

Liquidity and Capital Resources

The following table summarizes our cash flow activities:

(In thousands)	Year Ended December 31, 2022	2021	2020
Net loss	$ (1,131,156)	$ (852,824)	$ (858,281)
Non-cash adjustments to reconcile net loss to net cash used in operating activities:	625,435	373,954	256,021
Changes in operating assets and liabilities:	(35,553)	(162,823)	(12,701)
Net cash used in operating activities	(541,274)	(641,693)	(614,961)
Net cash provided by (used in) investing activities	169,354	(273,300)	(435,518)
Net cash provided by financing activities	425,753	1,247,118	994,979
Effect of exchange rate changes on cash, cash equivalents and restricted cash	(7,430)	(9,018)	4,918
Net increase (decrease) in cash, cash equivalents and restricted cash	46,403	323,107	(50,582)
Cash, cash equivalents and restricted cash, beginning of period	822,153	499,046	549,628
Cash, cash equivalents and restricted cash, end of period	$ 868,556	$ 822,153	$ 499,046

Operating Activities

Net cash used in operating activities decreased during the year ended December 31, 2022, compared to the year ended December 31, 2021, primarily due to decreased cash disbursements related to working capital payments and stronger cash receipts from increased product sales.

Investing Activities

Net cash provided by investing activities increased during the year ended December 31, 2022, compared to the year ended December 31, 2021, primarily due to net activities related to our marketable debt securities.

Financing Activities

Net cash provided by financing activities decreased during the year ended December 31, 2022, compared to the year ended December 31, 2021, primarily due to greater cash received in 2021, including $500.0 million received from our sale of one-half of our royalty interest under the Novartis agreement in September 2021 and $500.0 million received in connection with the second and final drawdowns on our credit agreement in June 2021 and December 2021, respectively, offset by $136.2 million

received from the issuance of convertible debt, net of repayment of credit facility and purchase of capped call transactions in September 2022.

Additional Capital Requirements

We currently have programs focused on a number of therapeutic areas and, as of December 31, 2022, have received regulatory approval and commercially launched four products. However, our ongoing development efforts may not be successful and we may not be able to commence sales of any other products or successfully expand the indications for our approved products, including ONPATTRO and AMVUTTRA in the future. In addition, we anticipate that we will continue to generate losses as a result of planned expenditures for research and development activities relating to our research platform, our drug development programs, including clinical trial and manufacturing costs, the establishment of late-stage clinical, manufacturing, commercial and compliance capabilities, including global operations, continued management and growth of our intellectual property including our patent portfolio, collaborations and general corporate activities.

Based on our current operating plan, we believe that our cash, cash equivalents and marketable securities as of December 31, 2022, together with the cash we expect to generate from product sales and under our current alliances, will be sufficient to satisfy our near-term capital and operating needs for at least the next 12 months from the filing of this Annual Report on Form 10-K. Recent and expected working and other capital requirements, in addition to the above matters, also include the items described below:

- Amounts related to future lease payments for operating lease obligations at December 31, 2022 totaled $460.1 million, with $43.0 million expected to be paid within the next 12 months.
- Our cash operating expenditures were $541.3 million in 2022 and $641.7 million in 2021, and we expect to increase our investment in operations in 2023.
- Cash outflows for capital expenditures were $72.1 million in 2022 and $76.4 million in 2021. We expect capital expenditures to increase in 2022 to support the increase in our manufacturing and production capacity needs.
- Amounts related to future long-term debt total $1.02 billion, of which we do not expect to make payments on principal within the next 12 months.
- Payments associated with the liability related to the sale of future royalties were approximately $3.4 million in 2022, with $40.3 million to be paid within the next 12 months.

Since we commenced operations in 2002, we have generated significant losses and as of December 31, 2022, we had an accumulated deficit of $6.57 billion. As of December 31, 2022, we had cash, cash equivalents and marketable securities of $2.19 billion, compared to $2.44 billion as of December 31, 2021.

Due to numerous factors described in more detail under the caption Part I, Item 1A, "Risk Factors" of this Annual Report on Form 10-K, we may require significant additional funds earlier than we currently expect in order to continue to commercialize ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO, and to develop, conduct clinical trials for, manufacture and, if approved, commercialize additional product candidates.

Critical Accounting Policies and Estimates

Our discussion and analysis of our financial condition and results of operations is based on our consolidated financial statements, which have been prepared in accordance with GAAP. The preparation of our consolidated financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenues and expenses, and disclosure of contingent assets and liabilities in our consolidated financial statements. Actual results may differ from these estimates under different assumptions or conditions and could have a material impact on our reported results. While our significant accounting policies are more fully described in the Notes to our consolidated financial statements included elsewhere in this Annual Report on Form 10-K, we believe the following accounting policies to be the most critical in understanding the judgments and estimates we use in preparing our consolidated financial statements:

Net Product Revenues

Our net product revenues are recognized, net of variable consideration related to certain allowances and accruals, at the time the customer obtains control of our product. We record reserves, based on contractual terms, for components related to product sold during the reporting period, as well as our estimate of product that remains in the distribution channel inventory at the end of the reporting period that we expect will be sold to qualified healthcare providers. On a quarterly basis, we update our estimates and record any needed adjustments in the period we identify the adjustments.

The estimates for our product revenue allowances and accruals are most significantly affected by chargebacks, which are contractual commitments with the government and other entities to sell products to qualified healthcare providers at prices lower than the list prices charged to the customer who directly purchases from us, and rebates that represent discount obligations under government programs, including Medicaid in the U.S. and similar programs in certain other countries,

including countries in which we are accruing for estimated rebates because final pricing has not yet been negotiated. We are also subject to potential rebates in connection with our VBAs with certain commercial payors.

We use the expected value method, which is the sum of probability-weighted amounts in a range of possible consideration amounts, or the most likely amount method, which is the single most likely amount in a range of possible considerations, to estimate variable consideration related to our product revenues. We use the expected value method to estimate variable consideration for chargebacks, certain rebates, and other incentives and we use the most likely amount method for certain rebates and trade discounts and allowances.

A 10% increase or decrease in these estimates impacts net sales by a corresponding increase or decrease of approximately $7.0 million.

Net Revenues from Collaborations

We earn revenue in connection with collaboration agreements which allow our collaboration partners to utilize our technology platforms and develop product candidates.

For elements of collaboration arrangements that are accounted for pursuant to ASC Topic 606, Revenue from Contracts with Customers, or ASC 606, we identify the performance obligations and allocate the total consideration we expect to receive on a relative standalone selling price basis to each performance obligation. Key assumptions to determine the standalone selling price may include forecasted revenues, development timelines, reimbursement rates for personnel costs, the expected number of targets or indications expected to be pursued under each license, discount rates and probabilities of technical and regulatory success. We recognize revenue associated with each performance obligation as the control over the promised goods or services transfer to our collaboration partner which occurs either at a point in time or over time. If control transfers over time, revenue is recognized by using a method of measuring progress that best depicts the transfer of goods or services, for example based on actual costs incurred relative to total forecasted costs to be incurred over the period the transfer of goods or services occurs. We evaluate the measure of progress and related inputs each reporting period and any resulting adjustments to revenue are recorded on a cumulative catch-up basis. Revenue to be recognized is equal to the total transaction price multiplied by the ratio of actual expense incurred divided by total forecasted expense.

A 10% increase or decrease in the transaction price impacts net revenues from collaborators by a corresponding increase or decrease of approximately $35.0 million. A 10% increase or decrease in the total forecasted costs to be incurred over the period the transfer of goods or services occurs impacts net revenues from collaborators by a corresponding decrease or increase of approximately $32.0 million.

Liability Related to the Sale of Future Royalties

We account for the liability related to the sale of future royalties as a debt financing, as we have significant continuing involvement in the generation of the cash flows. Interest on the liability related to the sale of future royalties will be recognized using the effective interest rate method over the life of the related royalty stream.

The liability related to the sale of future royalties and the related interest expense are based on our current estimates of future royalties and commercial milestones expected to be paid over the life of the arrangement, which we determine by using third-party forecasts of Leqvio's global net revenue. Third-party forecasts are updated periodically as new data is obtained with regards to Leqvio's global launch progress or as sales information becomes available. Increases, decreases or a shift in timing of estimated revenues affects the interest rate utilized in the calculation of the liability related to the sale of future royalties. An increase or decrease of 5% to the interest rate would result in an increase or decrease to our liability related to the sale of future royalties of approximately $15.8 million.

Development Derivative Liability

In August 2020, we entered into a co-development agreement, referred to as the Funding Agreement, with BXLS V Bodyguard – PCP L.P. and BXLS Family Investment Partnership V – ESC L.P., collectively referred to as Blackstone Life Sciences, pursuant to which Blackstone Life Sciences will provide up to $150.0 million in funding for the clinical development of vutrisiran and zilebesiran, two of our cardiometabolic programs. As consideration for Blackstone Life Sciences' funding for certain vutrisiran and zilebesiran clinical development costs, we have agreed to pay Blackstone Life Sciences fixed success-based payments upon achievement of specific milestones for vutrisiran and zilebesiran as well as a 1% royalty on net sales of vutrisiran for ten years.

The development derivative liability is recorded at fair value and represents our current estimate of the expected future payments to Blackstone Life Sciences. The development derivative liability is based on the probability weighted present value of the estimated cash flows pursuant to contractual terms of the Funding Agreement. The most significant assumptions in determining the development derivative liability are the probability of success for the clinical development and regulatory approval of vutrisiran and zilebesiran and our current cost of borrowing. Estimates of the probability of success and our cost of borrowing are based on what we believe to be reasonable and supportable assumptions and require management's judgment. Actual results could vary materially from these estimates.

Recent Accounting Pronouncements

Please read Note 2 to our consolidated financial statements included in Part II, Item 8, "Financial Statements and Supplementary Data," of this Annual Report on Form 10-K for a description of recent accounting pronouncements applicable to our business.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Interest Rate Risk - Investment Portfolio. We invest a portion of our cash in a number of diversified fixed- and floating-rate securities consisting of cash equivalents, marketable debt securities, debt funds and derivative instruments related to our investment portfolio that are subject to interest rate risk. Changes in the general level of interest rates can affect the fair value of our investment portfolio. If interest rates in the general economy were to rise, our holdings could lose value. As of December 31, 2022 and 2021, a hypothetical increase in interest rates of 50 basis points across the entire yield curve on our holdings would have resulted in an immaterial decrease to the fair value of our holdings.

Foreign Currency Exchange Risk. As a result of our foreign operations, we face exposure to movements in foreign currency exchange rates, primarily the Euro and Yen against the U.S. Dollar. Fluctuations in the global markets may have a positive or negative effect on our foreign exchange rate exposure. The current exposures arise primarily from net product revenue, operating costs and expenses and balance sheet amounts. Therefore, significant changes in foreign exchange rates of the countries outside the United States where our products are sold, where development expenses are incurred by us or our collaborators, or where we incur operating expenses can impact our operating results and financial condition. As sales outside the United States continue to grow, and as we expand our international operations, we will continue to assess potential steps, including foreign currency hedging and other strategies, to mitigate our foreign exchange risk.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

Report of Independent Registered Public Accounting Firm

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

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of Alnylam Pharmaceuticals, Inc. and its subsidiaries (the "Company") as of December 31, 2022 and 2021, and the related consolidated statements of operations and comprehensive loss, of stockholders' (deficit) equity and of cash flows for each of the three years in the period ended December 31, 2022, including the related notes (collectively referred to as the "consolidated financial statements"). We also have audited the Company's internal control over financial reporting as of December 31, 2022, based on criteria established in Internal Control - Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2022 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2022, based on criteria established in Internal Control - Integrated Framework (2013) issued by the COSO.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in Management's Annual Report on Internal Control Over Financial Reporting appearing under Item 9A. Our responsibility is to express opinions on the Company's consolidated financial statements and on the Company's internal control over financial reporting 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 audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) 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 (iii) 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. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that (i) relates to accounts or disclosures that are material to the consolidated financial statements and (ii) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated

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.

Liability Related to Sale of Future Royalties and Commercial Milestones

As described in Notes 2 and 5 to the consolidated financial statements, the liability related to the sale of future royalties and the related interest expense are based on management's current estimates of future royalties and commercial milestones expected to be paid over the life of the arrangement. Interest on the liability related to the sale of future royalties will be recognized using the effective interest rate method, resulting in the recognition of interest expense. Management periodically assesses the expected payments and to the extent the amount or timing of the future estimated payments is materially different than the previous estimates, management accounts for any such change by adjusting the liability related to the sale of future royalties and prospectively recognizing the related non-cash interest expense. Management's estimate of the amount of expected future payments to Blackstone over the life of the arrangement is based on the estimated global net sales of Leqvio. The Company recorded a liability related to the sale of future royalties of $1.29 billion as of December 31, 2022 and recognized interest expense on the liability related to the sale of future royalties of $107.6 million for the year ended December 31, 2022.

The principal considerations for our determination that performing procedures relating to the liability related to the sale of future royalties and commercial milestones is a critical audit matter are the significant judgment by management when developing the estimate of the timing and amount of future royalties and commercial milestones to be paid. This in turn led to a high degree of auditor judgment and effort in performing procedures and in evaluating audit evidence relating to management's estimate of the expected future royalties and commercial milestones to be paid and the selection of third party data used to estimate global net sales of Leqvio.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to the liability for future royalties and commercial milestones, including controls over management's process for developing the estimate of timing and amount of future royalties and commercial milestones to be paid. These procedures also included, among others (i) testing management's process for developing the estimate of timing and amount of future royalties and commercial milestones to be paid and (ii) evaluating the reasonableness of significant assumptions used by management when developing the estimate of expected future royalties and commercial milestones to be paid related to the selection of third party data used to estimate global net sales of Leqvio. Evaluating management's assumption related to the selection of third-party data used to estimate global net sales of Leqvio involved evaluating whether the assumptions used by management were reasonable considering consistency with industry data.

/s/PricewaterhouseCoopers LLP
Boston, Massachusetts
February 23, 2023

We have served as the Company's auditor since 2003.

ALNYLAM PHARMACEUTICALS, INC.
CONSOLIDATED BALANCE SHEETS
(In thousands, except per share amounts)

	December 31, 2022	December 31, 2021
ASSETS		
Current assets:		
Cash and cash equivalents	$ 866,394	$ 819,975
Marketable debt securities	1,297,890	1,548,617
Marketable equity securities	28,122	66,972
Accounts receivable, net	237,963	198,571
Inventory	128,962	86,363
Prepaid expenses and other current assets	132,916	88,078
Total current assets	2,692,247	2,808,576
Property, plant and equipment, net	523,494	501,958
Operating lease right-of-use assets	215,136	231,675
Restricted investments	49,390	40,891
Other assets	66,092	60,204
Total assets	$ 3,546,359	$ 3,643,304
LIABILITIES AND STOCKHOLDERS' (DEFICIT) EQUITY		
Current liabilities:		
Accounts payable	$ 98,094	$ 73,426
Accrued expenses	545,460	395,174
Operating lease liability	41,967	40,548
Deferred revenue	42,105	149,483
Liability related to the sale of future royalties	40,289	37,079
Total current liabilities	767,915	695,710
Operating lease liability, net of current portion	261,339	281,347
Deferred revenue, net of current portion	193,791	152,360
Convertible debt	1,016,942	—
Long-term debt, net	—	675,697
Liability related to the sale of future royalties, net of current portion	1,252,015	1,151,024
Other liabilities	212,580	98,963
Total liabilities	3,704,582	3,055,101
Commitments and contingencies (Note 14)		
Stockholders' (deficit) equity:		
Preferred stock, $0.01 par value per share, 5,000 shares authorized and no shares issued and outstanding as of December 31, 2022 and December 31, 2021	—	—
Common stock, $0.01 par value per share, 250,000 shares authorized as of December 31, 2022 and December 31, 2021, respectively; 123,925 shares issued and outstanding as of December 31, 2022; 120,182 shares issued and outstanding as of December 31, 2021	1,240	1,202
Additional paid-in capital	6,454,540	6,058,453
Accumulated other comprehensive loss	(44,654)	(33,259)
Accumulated deficit	(6,569,349)	(5,438,193)
Total stockholders' (deficit) equity	(158,223)	588,203
Total liabilities and stockholders' (deficit) equity	$ 3,546,359	$ 3,643,304

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

ALNYLAM PHARMACEUTICALS, INC.
CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE LOSS
(In thousands, except per share amounts)

	Year Ended December 31,		
	2022	2021	2020
Statements of Operations			
Revenues:			
Net product revenues	$ 894,329	$ 662,138	$ 36
Net revenues from collaborations	134,912	180,953	13
Royalty revenue	8,177	1,196	
Total revenues	1,037,418	844,287	49
Operating costs and expenses:			
Cost of goods sold	140,174	115,005	7
Cost of collaborations and royalties	28,643	25,139	
Research and development	883,015	792,156	65
Selling, general and administrative	770,658	620,639	58
Total operating costs and expenses	1,822,490	1,552,939	1,32
Loss from operations	(785,072)	(708,652)	(82
Other (expense) income:			
Interest expense	(155,968)	(143,021)	(8
Other (expense) income, net	(109,367)	(471)	5
Loss on the extinguishment of debt	(76,586)	—	
Total other expense, net	(341,921)	(143,492)	(2
Loss before income taxes	(1,126,993)	(852,144)	(85
Provision for income taxes	(4,163)	(680)	(
Net loss	$ (1,131,156)	$ (852,824)	$ (85
Net loss per common share — basic and diluted	$ (9.30)	$ (7.20)	$
Weighted-average common shares used to compute basic and diluted net loss per common share	121,689	118,451	11
Statements of Comprehensive Loss			
Net loss	$ (1,131,156)	$ (852,824)	$ (85
Other comprehensive (loss) income:			
Unrealized (loss) gain on marketable securities	(7,840)	(1,978)	
Foreign currency translation (loss) gain	(5,274)	11,398	(
Defined benefit pension plans, net of tax	1,719	943	
Total other comprehensive (loss) income	(11,395)	10,363	(
Comprehensive loss	$ (1,142,551)	$ (842,461)	$ (86

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

ALNYLAM PHARMACEUTICALS, INC.
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' (DEFICIT) EQUITY
(In thousands, except share amounts)

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive (Loss) Income	Accumulated Deficit	Tota Stockhol (Deficit) I
	Shares	Amount				
Balance at December 31, 2019	112,188	$ 1,122	$ 5,201,176	$ (36,518)	$ (3,727,088)	$ 1,43
Exercise of common stock options, net of tax withholdings	2,926	28	189,343	—	—	18
Issuance of common stock under equity plans	350	4	11,079	—	—	1
Issuance of common stock to strategic partners, net of closing costs	963	10	99,488	—	—	9
Stock-based compensation expense	—	—	142,988	—	—	14
Other comprehensive loss	—	—	—	(7,104)	—	(
Net loss	—	—	—	—	(858,281)	(85
Balance at December 31, 2020	116,427	1,164	5,644,074	(43,622)	(4,585,369)	1,01
Exercise of common stock options, net of tax withholdings	2,978	30	232,456	—	—	23
Issuance of common stock under equity plans	777	8	13,623	—	—	1
Stock-based compensation expense	—	—	168,300	—	—	16
Other comprehensive gain	—	—	—	10,363	—	1
Net loss	—	—	—	—	(852,824)	(85
Balance at December 31, 2021	120,182	1,202	6,058,453	(33,259)	(5,438,193)	58
Exercise of common stock options, net of tax withholdings	3,103	32	263,580	—	—	26
Issuance of common stock under equity plans	640	6	13,719	—	—	1
Stock-based compensation expense	—	—	237,399	—	—	23
Purchase of capped calls related to convertible debt	—	—	(118,611)	—	—	(11
Other comprehensive loss	—	—	—	(11,395)	—	(1
Net loss	—	—	—	—	(1,131,156)	(1,13
Balance at December 31, 2022	123,925	$ 1,240	$ 6,454,540	$ (44,654)	$ (6,569,349)	$ (15

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

ALNYLAM PHARMACEUTICALS, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS
(In thousands)

	Year Ended December 31,		
	2022	**2021**	**2020**
Cash flows from operating activities:			
Net loss	$ (1,131,156)	$ (852,824)	$ (858,281)
Non-cash adjustments to reconcile net loss to net cash used in operating activities:			
Depreciation and amortization	44,468	47,567	34,772
Amortization and interest accretion related to operating leases	41,082	42,127	39,663
Non-cash interest expense on liability related to the sale of future royalties	104,200	116,562	84,496
Stock-based compensation	230,649	165,717	139,873
Realized and unrealized loss (gain) on marketable equity securities	33,312	(55,695)	(54,042)
Loss on extinguishment of debt	76,586	—	—
Change in fair value of development derivative liability	94,659	38,433	17,185
Other	479	19,243	(5,926)
Changes in operating assets and liabilities:			
Accounts receivable, net	(45,597)	(101,799)	(56,236)
Inventory	(34,136)	(26,415)	(35,426)
Prepaid expenses and other assets	(38,507)	(32,093)	13,017
Accounts payable, accrued expenses and other liabilities	191,769	88,240	143,732
Operating lease liability	(43,171)	(40,352)	(33,823)
Deferred revenue	(65,911)	(50,404)	(43,965)
Net cash used in operating activities	(541,274)	(641,693)	(614,961)
Cash flows from investing activities:			
Purchases of property, plant and equipment	(72,059)	(76,372)	(70,361)
Purchases of marketable securities	(1,976,961)	(1,656,114)	(2,025,626)
Sales and maturities of marketable securities	2,231,568	1,463,550	1,691,669
Proceeds from maturity of restricted investments	89,951	41,975	—
Purchases of restricted investments	(98,451)	(42,141)	(25,900)
Other investing activities	(4,694)	(4,198)	(5,300)
Net cash provided by (used in) investing activities	169,354	(273,300)	(435,518)
Cash flows from financing activities:			
Proceeds from exercise of stock options and other types of equity, net	259,360	246,268	200,484
Proceeds from convertible debt, net	1,016,111	—	—
Repayment of term loan	(762,107)	—	—
Purchases of capped calls related to convertible debt	(118,611)	—	—
Proceeds from the sale of future royalties	—	500,000	500,000
Proceeds from development derivative	31,000	19,600	8,400
Proceeds from term loan facility	—	500,000	200,000
Proceeds from issuance of common stock to strategic partners, net of closing costs	—	—	99,498
Other financing activities	—	(18,750)	(13,403)
Net cash provided by financing activities	425,753	1,247,118	994,979
Effect of exchange rate changes on cash, cash equivalents and restricted cash	(7,430)	(9,018)	4,918
Net increase (decrease) in cash, cash equivalents and restricted cash	46,403	323,107	(50,582)
Cash, cash equivalents and restricted cash, beginning of period	822,153	499,046	549,628
Cash, cash equivalents and restricted cash, end of period	$ 868,556	$ 822,153	$ 499,046
Supplemental disclosure of cash flows:			
Cash paid for interest	$ 45,235	$ 24,657	$ —
Supplemental disclosure of noncash investing and financing activities:			
Capital expenditures included in accounts payable and accrued expenses	$ 5,213	$ 13,599	$ 14,518
Lease liabilities arising from obtaining right-of-use assets	$ 1,013	$ 7,932	$ 34,435
Receivable and liability related to the sale of future royalties	$ —	$ —	$ 500,000

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

1. NATURE OF BUSINESS

Alnylam Pharmaceuticals, Inc. (also referred to as Alnylam, we, our or us) commenced operations on June 14, 2002 as a biopharmaceutical company seeking to develop and commercialize novel therapeutics based on ribonucleic acid interference, or RNAi. We are committed to the advancement of our company strategy of building a multi-product, global, commercial biopharmaceutical company with a deep and sustainable clinical pipeline of RNAi therapeutics for future growth and a robust, organic research engine for sustainable innovation and great potential for patient impact. Since inception, we have focused on discovering, developing and commercializing RNAi therapeutics by establishing and maintaining a strong intellectual property position in the RNAi field, establishing strategic alliances with leading pharmaceutical and life sciences companies, generating revenues through licensing agreements, and ultimately developing and commercializing RNAi therapeutics globally, either independently or with our strategic partners. We have devoted substantially all of our efforts to business planning, research, development, manufacturing and early commercial efforts, acquiring, filing and expanding intellectual property rights, recruiting management and technical staff, and raising capital.

In early 2021, we launched our *Alnylam P^{5}x25* strategy, which focuses on our planned transition to a top-tier biotech company by the end of 2025. With *Alnylam P^{5}x25*, we aim to deliver transformative rare and prevalent disease medicines for patients around the world through sustainable innovation, delivering exceptional financial performance and driving profitability.

As of December 31, 2022, we have five products that have received marketing approval, including one partnered product, and multiple late-stage investigational programs advancing towards potential commercialization. We currently generate worldwide product revenues from four commercialized products, ONPATTRO, AMVUTTRA, GIVLAARI and OXLUMO, primarily in the United States, or U.S., Europe and Japan.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Basis of Presentation and Principles of Consolidation

The accompanying consolidated financial statements reflect the operations of Alnylam and our wholly-owned subsidiaries. All intercompany accounts and transactions have been eliminated.

Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America, or GAAP, requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the consolidated financial statements and the reported amounts of revenues and expenses during the reporting period. In our consolidated financial statements, we use estimates and assumptions related to our inventory valuation and related reserves, liability related to the sale of future royalties, development derivative liability, income taxes, revenue recognition, research and development expenses, and stock-based compensation. We base our estimates on historical experience and on various other assumptions that we believe to be reasonable. Actual results could differ from those estimates.

Liquidity

Based on our current operating plan, we believe that our cash, cash equivalents and marketable securities as of December 31, 2022, together with the cash we expect to generate from product sales and under our current alliances, will be sufficient to enable us to advance our *Alnylam P^{5}x25* strategy for at least the next 12 months from the filing of this Annual Report on Form 10-K.

Concentrations of Credit Risk and Significant Customers

Financial instruments that potentially expose us to concentrations of credit risk primarily consist of cash, cash equivalents and marketable securities. As of December 31, 2022 and 2021, substantially all of our cash, cash equivalents and marketable securities were invested in money market funds, certificates of deposit, commercial paper, corporate notes, U.S. government-sponsored enterprise securities and U.S. treasury securities through highly rated financial institutions. Corporate notes may also include foreign bonds denominated in U.S. dollars. Investments are restricted, in accordance with our investment policy, to a concentration limit per issuer.

During the years ended December 31, 2022, 2021 and 2020, our revenues were generated primarily from product sales to distributors and collaborations with strategic partners. For the years ended December 31, 2022, 2021 and 2020, our gross accounts receivable balance was comprised of payments primarily due from distributors for product sales and our strategic partners.

The following table summarizes customers that represent 10% or greater of our consolidated total gross revenues:

	Year Ended December 31,		
	2022	2021	2020
Distributor A	33 %	27 %	31 %
Regeneron Pharmaceuticals	*	11%	12%

* Represents less than 10%

The following table summarizes customers with amounts due that represent 10% or greater of our consolidated gross accounts receivable balance:

	As of December 31,	
	2022	2021
Distributor A	32 %	14 %
Distributor B	10 %	10 %
Novartis AG	*	20 %
Regeneron Pharmaceuticals	*	12 %

* Represents less than 10%

Fair Value Measurements

The fair value is 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. In general, fair values determined by Level 1 inputs utilize quoted prices (unadjusted) in active markets for identical assets or liabilities. Fair values determined by Level 2 inputs utilize data points that are observable, such as quoted prices (adjusted), interest rates and yield curves. Fair values determined by Level 3 inputs utilize unobservable data points for the asset or liability, and include situations where there is little, if any, market activity for the asset or liability. The fair value hierarchy level is determined by the lowest level of significant input.

Investments in Marketable Securities and Cash Equivalents

We invest our excess cash balances in marketable debt securities and classify our investments as either held-to-maturity or available-for-sale based on facts and circumstances present at the time we purchased the securities. At each balance sheet date presented, we classified all of our investments in debt securities as available-for-sale and as current assets as they represent the investment of funds available for current operations. We report available-for-sale debt securities at fair value at each balance sheet date and include any unrealized holding gains and losses (the adjustment to fair value) in accumulated other comprehensive (loss) income, a component of stockholders' (deficit) equity. Realized gains and losses are determined using the specific identification method and are included in other income (expense). If any adjustment to fair value reflects a decline in the value of the marketable debt securities, we consider all available evidence to evaluate if an impairment loss exists, and if so, mark the investment to market through a charge to our consolidated statements of operations and comprehensive loss. We did not record any impairment charges related to our marketable debt securities during the years ended December 31, 2022, 2021 or 2020. Our marketable debt securities are classified as cash equivalents if the original maturity, from the date of purchase, is 90 days or less, and as marketable debt securities if the original maturity, from the date of purchase, is in excess of 90 days. Our cash equivalents are generally composed of commercial paper, corporate notes, U.S. government-sponsored enterprise securities, U.S. treasury securities and money market funds.

We measure marketable equity investments (except those accounted for under the equity method of accounting or those that result in consolidation of an investee), which have readily available prices, at fair value with changes in fair value recognized in other income (expense) on our consolidated statements of operations and comprehensive loss. We obtain fair value measurement data for our marketable debt securities from independent pricing services. We perform validation procedures to ensure the reasonableness of this data. This includes discussing with the independent pricing services to understand the methods and data sources used. For our marketable debt securities, we perform our own review of prices received from the independent pricing services by comparing these prices to other sources and for our marketable equity securities, we confirm those securities are trading in active markets.

Accounts Receivable

We record accounts receivable net of customer allowances for distribution services, prompt payment discounts and chargebacks based on contractual terms. As of December 31, 2022 and 2021, based on our estimation of expected write-offs, we determined an allowance for doubtful accounts was not material. We have standard payment terms that generally require

payment within approximately 30 to 90 days. Accounts receivable, net on our consolidated balance sheets also includes billed and unbilled collaboration receivables.

Inventory

Inventory is measured at the lower of cost or estimated net realizable value and classified based on the anticipation of when it will be consumed either within our normal operating cycle (short-term) or beyond (long-term). We use a standard cost basis, which approximates cost determined on a first-in, first-out basis. Inventory costs include all raw materials, direct conversion costs and overhead. Raw and intermediate materials that may be used for either research and development or commercial purposes are classified as inventory until the material is consumed or otherwise allocated for research and development. If the material is used for research and development, it is expensed as research and development once that determination is made.

We capitalize inventory costs that are expected to be sold commercially once we determine it is probable that the inventory costs will be recovered through commercial sale based on the review of several factors, including (i) the likelihood that all required regulatory approvals will be received, considering any special filing status, (ii) the expected timing of validation (if not yet completed) of manufacturing processes in the associated facility, (iii) the expected expiration of the inventory, (iv) logistical or commercial constraints that may impede the timely distribution and sale of the product, including transport requirements and reimbursement status, (v) current market factors, including competitive landscape and pricing, (vi) threatened or anticipated litigation challenges, (vii) history of approvals of similar products or formulations, and (viii) FDA (or other appropriate regulatory agencies) correspondence regarding the safety and efficacy of the product. Prior to the capitalization of inventory costs, we record such costs as research and development expenses on our consolidated statements of operations and comprehensive loss.

We reduce our inventory to net realizable value for potentially excess, dated or obsolete inventory based on our quarterly assessment of the recoverability of our capitalized inventory. We periodically review inventory levels to identify what may expire prior to expected sale or has a cost basis in excess of its estimated realizable value and write-down such inventories as appropriate.

Property, Plant and Equipment

Property, plant and equipment are stated at cost, net of accumulated depreciation. Depreciation expense is recorded on a straight-line basis over the estimated useful life of the asset. Construction in progress reflects amounts incurred for construction or improvements of property, plant or equipment that have not been placed in service. Costs of construction of certain long-lived assets include capitalized interest, which is amortized over the estimated useful life of the related asset. The cost and accumulated depreciation of assets retired or sold are removed from the respective asset category, and any gain or loss is recognized in our consolidated statements of operations and comprehensive loss. During the years ended December 31, 2022, 2021 and 2020, we recorded $39.1 million, $36.8 million and $30.2 million, respectively, of depreciation expense related to our property, plant and equipment.

The estimated useful lives of property, plant and equipment are as follows:

Asset Category	Useful Life
Laboratory equipment	5
Computer equipment and software	3-10 years
Furniture and fixtures	5
Leasehold improvements	Shorter of asset life or lease term
Manufacturing Equipment	7-15 years
Buildings	40 years

Leases

We determine if an arrangement is a lease at contract inception based on the facts and circumstances present in the arrangement. All of our leases are classified as operating leases. We record operating lease assets and lease liabilities in our consolidated balance sheets. Operating lease assets represent our right to use an underlying asset for the lease term and operating lease liabilities represent our obligation to make lease payments arising from the leasing arrangement. Operating lease assets and operating lease liabilities are recognized at commencement date based on the present value of lease payments over the lease term. As most of our leases do not provide an implicit rate, in determining the operating lease liabilities, we use an estimate of our incremental borrowing rate based on the information available at commencement. Lease expense for lease payments is recognized on a straight-line basis over the lease term. Short-term leases, or leases that have a lease term of 12

months or less at commencement date, are excluded from this treatment and are recognized on a straight-line basis over the term of the lease.

Clinical Accruals

We record accrued liabilities related to products we have received or services that we have incurred, specifically related to ongoing pre-clinical studies and clinical trials, for which service providers have not yet billed us, or when billing terms under these contracts do not coincide with the timing of when the work is performed, as of our period-end. These costs primarily relate to third-party clinical management costs, laboratory and analysis costs, toxicology studies and investigator fees. The assessment of these costs is a subjective process, requiring judgment based on our knowledge of the research and development programs, services performed for the period, experience with related activities and the expected duration of the third-party service contract, where applicable. Upon settlement, these costs may differ materially from the amounts accrued in our consolidated financial statements. Our historical accrual estimates have not been materially different from our actual costs.

Revenue Recognition

We recognize revenue when control of promised goods or services is transferred to a customer at an amount that reflects the consideration to which we expect to be entitled in exchange for those goods or services. To determine revenue recognition, we perform 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, including variable consideration, if any; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when (or as) we satisfy a performance obligation. We only apply the five-step model to contracts when collectability of the consideration to which we are entitled in exchange for the goods or services we transfer to the customer is determined to be probable.

At contract inception, once the contract is determined to be within the scope of Accounting Standards Codification Topic 606, Revenue from Contracts with Customers, or ASC 606, we assess whether the goods or services promised within each contract are distinct and, therefore, represent a separate performance obligation. Goods and services that are determined not to be distinct are combined with other promised goods and services until a distinct bundle is identified. We then allocate the transaction price (the amount of consideration we expect to be entitled to from a customer in exchange for the promised goods or services) to each performance obligation and recognize the associated revenue when (or as) each performance obligation is satisfied. Our estimate of the transaction price for each contract includes all variable consideration to which we expect to be entitled.

Amounts are recorded as accounts receivable when our right to consideration is unconditional. We do not assess whether a contract has a significant financing component if the expectation at contract inception is that the period between payment by the customer and the transfer of the promised goods or services to the customer will be one year or less. We expense incremental costs of obtaining a contract as and when incurred if the expected amortization period of the asset that we would have recognized is one year or less or the amount is immaterial. As of December 31, 2022 and 2021, we had not capitalized any costs to obtain any of our contracts.

Net Product Revenues

Our net product revenues are recognized, net of variable consideration related to certain allowances and accruals, at the time the customer obtains control of our product. We use the expected value method, which is the sum of probability-weighted amounts in a range of possible consideration amounts, or the most likely amount method, which is the single most likely amount in a range of possible considerations, to estimate variable consideration related to our product sales. We use the expected value method to estimate variable consideration for certain rebates, chargebacks, product returns, and other incentives and we use the most likely amount method for certain rebates and trade discounts and allowances.

We record reserves, based on contractual terms, for components related to product sold during the reporting period, as well as our estimate of product that remains in the distribution channel inventory at the end of the reporting period that we expect will be sold to qualified healthcare providers. On a quarterly basis, we update our estimates and record any needed adjustments in the period we identify the adjustments. The following are the components of variable consideration related to product revenues:

Chargebacks: We estimate obligations resulting from contractual commitments with the government and other entities to sell products to qualified healthcare providers at prices lower than the list prices charged to the customer who directly purchases from us. The customer charges us for the difference between what it pays to us for the product and the selling price to the qualified healthcare providers.

Rebates: We are subject to discount obligations under government programs, including Medicaid in the U.S. and similar programs in certain other countries, including countries in which we are accruing for estimated rebates because final pricing has not yet been negotiated. We are also subject to potential rebates in connection with our value-based agreements with certain commercial payors. We record reserves for rebates in the same period the related product revenue is recognized, resulting in a reduction of product revenues and a current liability that is included in accrued expenses on our consolidated balance sheet. Our

estimate for rebates is based on statutory discount rates, expected utilization or an estimated number of patients on treatment, as applicable.

Trade discounts and allowances: We provide customary invoice discounts on product sales to our customers for prompt payment and we pay fees for distribution services, such as fees for certain data that customers provide to us. We estimate our customers will earn these discounts and fees, and deduct these discounts and fees in full from gross product revenues and accounts receivable at the time we recognize the related revenues.

Product returns: We offer customers product return rights if products are damaged, defective or expired, with "expired" defined within each customer agreement. We estimate the amount of product that will be returned using a probability-weighted estimate based on our sales history.

Other incentives: Other incentives include co-payment assistance we provide to patients with commercial insurance that have coverage and reside in states that allow co-payment assistance. We estimate the average co-payment assistance amounts for our products based on expected customer demographics and record any such amounts within accrued expenses on our consolidated balance sheet.

Net Revenues from Collaborations

We earn revenue in connection with collaboration agreements which allow our collaboration partners to utilize our technology platforms and develop product candidates. Our collaboration agreements are detailed in Note 4, Net Revenues from Collaborations. For each collaboration partner, we discuss our revenue recognition, including our significant performance obligations under each agreement.

At contract inception, we assess whether the collaboration arrangements are within the scope of ASC Topic 808, Collaborative Arrangements, or ASC 808, to determine whether such arrangements involve joint operating activities performed by parties that are both active participants in the activities and exposed to significant risks and rewards dependent on the commercial success of such activities. This assessment is performed based on the responsibilities of all parties in the arrangement. For collaboration arrangements within the scope of ASC 808 that contain multiple elements, we first determine which elements of the arrangement are within the scope of ASC 808 and which elements are within the scope of ASC 606. For elements of collaboration arrangements that are accounted for pursuant to ASC 808, an appropriate recognition method is determined and applied consistently, either by analogy to authoritative accounting literature or by applying a reasonable and rational policy election.

For elements of collaboration arrangements that are accounted for pursuant to ASC 606, we identify the performance obligations and allocate the total consideration we expect to receive on a relative standalone selling price basis to each performance obligation. Variable consideration such as performance-based milestones will be included in the total consideration if we expect to receive such consideration and if it is probable that the inclusion of the variable consideration will not result in a significant reversal in the cumulative amount of revenue recognized under the arrangement. Our estimate of the total consideration we expect to receive under each collaboration arrangement is updated for each reporting period, and any adjustments to revenue are recorded on a cumulative catch-up basis. We exclude sales-based royalty and milestone payments from the total consideration we expect to receive until the underlying sales occur because the license to our intellectual property is deemed to be the predominant item to which the royalties or milestones relate as it is the primary driver of value in our collaboration arrangements.

Key assumptions to determine the standalone selling price may include forecasted revenues, development timelines, reimbursement rates for personnel costs, discount rates and probabilities of technical and regulatory success. We recognize revenue associated with each performance obligation as the control over the promised goods or services transfer to our collaboration partner which occurs either at a point in time or over time. If control transfers over time, revenue is recognized by using a method of measuring progress that best depicts the transfer of goods or services. We evaluate the measure of progress and related inputs each reporting period and any resulting adjustments to revenue are recorded on a cumulative catch-up basis.

Consideration received that does not meet the requirements to satisfy ASC 808 or ASC 606 revenue recognition criteria is recorded as deferred revenue in the accompanying consolidated balance sheets, classified as either short-term (less than 12 months) or long-term (more than 12 months) deferred revenue based on our best estimate of when such revenue will be recognized.

Cost of Goods Sold

Cost of goods sold includes the cost of producing and distributing inventories that are related to product revenues during the respective period (including salary-related and stock-based compensation expenses for employees involved with production and distribution, freight and indirect overhead costs), third-party royalties payable on our net product revenues, amortization of intangible assets associated with the sale of our products and costs related to sales of product supply under our collaboration agreements. Cost of goods sold may also include costs related to excess or obsolete inventory adjustment charges, abnormal costs, unabsorbed manufacturing and overhead costs, and manufacturing variances.

Cost of Collaborations and Royalties

Cost of collaborations and royalties includes costs we incur in connection with providing commercial drug supplies, such as GalNAc material, to collaborators, in addition to royalties we owe to third parties on the net sales of licensed products by Novartis.

Income Taxes

We account for income taxes under the asset and liability method. Under this method, deferred tax assets and liabilities are recognized for the estimated future tax consequences attributable to differences between financial statement carrying amounts of existing assets and liabilities and their respective tax basis. Deferred tax assets and liabilities are measured using enacted rates in effect for the year in which these temporary differences are expected to be recovered or settled. Valuation allowances are provided if, based on the weight of available evidence, it is more likely than not that some or all of the deferred tax assets will not be realized.

Uncertain tax positions, for which management's assessment is that there is a more than 50% probability of sustaining the position upon challenge by a taxing authority based upon its technical merits, are subject to certain recognition and measurement criteria. The nature of the uncertain tax positions is often very complex and subject to change, and the amounts at issue can be substantial. We develop our cumulative probability assessment of the measurement of uncertain tax positions using internal experience, judgment and assistance from professional advisors. We re-evaluate these uncertain tax positions on a quarterly basis based on a number of factors including, but not limited to, changes in facts or circumstances, changes in tax law, and effectively settled issues under audit and new audit activity. Any change in these factors could result in the recognition of a tax benefit or an additional charge to the tax provision.

Research and Development Expenses

We record research and development expenses as incurred. Included in research and development expenses are wages, stock-based compensation expenses, benefits and other operating costs, facilities, supplies, external services, clinical trial and manufacturing costs, certain costs related to our collaboration arrangements, and overhead directly related to our research and development operations, as well as costs to acquire technology licenses.

We have entered into several license agreements for rights to utilize certain technologies. The terms of the licenses may provide for upfront payments, annual maintenance payments, milestone payments based upon certain specified events being achieved and royalties on product sales. We charge costs to acquire and maintain licensed technology that has not reached technological feasibility and does not have alternative future use to research and development expense as incurred. During the years ended December 31, 2022, 2021 and 2020, we charged to research and development expense costs associated with license fees of $7.3 million, $16.8 million and $2.8 million, respectively.

Stock-Based Compensation

We recognize stock-based compensation expense for grants under our stock incentive plans and employee stock purchase plan. We account for all stock-based awards granted to employees at their fair value and recognize compensation expense over the vesting period of the award. Determining the amount of stock-based compensation to be recorded requires us to develop estimates of fair values of stock options as of the grant date. We calculate the grant date fair values of stock options using the Black-Scholes valuation model, which requires the input of subjective assumptions, including but not limited to expected stock price volatility over the term of the awards and the expected term of stock options. The fair value of restricted stock awards granted to employees is based upon the quoted closing market price per share on the date of grant.

We have performance conditions included in certain of our restricted stock awards that are based upon the achievement of pre-specified clinical development, regulatory, commercial and/or financial performance events. As the outcome of each event has inherent risk and uncertainties, and a positive outcome may not be known until the event is achieved, we begin to recognize the value of the performance-based restricted stock awards when we determine the achievement of each performance condition is deemed probable, a determination which requires significant judgment by management. At the probable date, we record a cumulative expense catch-up, with remaining expense amortized over the remaining service period.

Liability Related to the Sale of Future Royalties

We account for the liability related to the sale of future royalties as a debt financing, as we have significant continuing involvement in the generation of the cash flows. Interest on the liability related to the sale of future royalties will be recognized using the effective interest rate method over the life of the related royalty stream.

The liability related to the sale of future royalties and the related interest expense are based on our current estimates of future royalties and commercial milestones expected to be paid over the life of the arrangement, which we determine by using third-party forecasts of Leqvio’s global net revenue. We will periodically assess the expected payments and to the extent the amount or timing of our future estimated payments is materially different than our previous estimates, we will account for any

such change by adjusting the liability related to the sale of future royalties and prospectively recognizing the related non-cash interest expense.

Development Derivative Liability

Development derivative liability is recorded at fair value based on the probability weighted present value of the estimated cash flows pursuant to contractual terms of the funding agreement. The liability is remeasured quarterly with any change in fair value recorded in other income (expense) on the consolidated statements of operations and comprehensive loss.

Comprehensive Loss

Comprehensive loss is comprised of net loss and certain changes in stockholders' (deficit) equity that are excluded from net loss. We include unrealized gains and losses on certain marketable securities in other comprehensive loss, including changes in the value of our marketable debt securities. We include foreign currency translation adjustments in other comprehensive loss if the functional currency is not the U.S. dollar. We include certain changes in the fair value of the plan assets and projected benefit obligation attributed to our defined benefit pension plan in other comprehensive loss.

Net Loss per Common Share

We compute basic net loss per common share by dividing net loss by the weighted-average number of common shares outstanding. We compute diluted net loss per common share by dividing net loss by the weighted-average number of common shares and dilutive potential common share equivalents then outstanding during the period. In the diluted net loss per share calculation, net loss would be adjusted for the elimination of interest expense on the Convertible debt. Potential common shares consist of shares issuable upon the exercise of stock options (the proceeds of which are then assumed to have been used to repurchase outstanding shares using the treasury stock method) or upon conversion of the convertible debt outstanding during the period (calculated using the if-converted method assuming the conversion of the convertible debt as of the earliest period reported or at the date of issuance, if later). Because the inclusion of potential common shares would be anti-dilutive for all periods presented, diluted net loss per common share is the same as basic net loss per common share.

The following table sets forth the potential common shares (prior to consideration of the treasury stock or if-converted methods) excluded from the calculation of net loss per common share because their inclusion would be anti-dilutive:

	As of December 31,		
(In thousands)	**2022**	**2021**	**2020**
Options to purchase common stock, inclusive of performance-based stock options	8,424	10,015	11,692
Unvested restricted common stock, inclusive of performance-based restricted common stock	1,487	1,210	1,160
Convertible debt	3,616	—	—
Total	13,527	11,225	12,852

Segment Information

We operate in a single reporting segment, the discovery, development and commercialization of RNAi therapeutics. Consistent with our management reporting, results of our operations are reported on a consolidated basis for purposes of segment reporting. As of December 31, 2022 and 2021, substantially all of our consolidated property, plant and equipment, net, was from U.S. operations. For the years ended December 31, 2022, 2021 and 2020, net revenues from collaborations were attributed to the U.S. Please read Note 3 for information regarding our net product sales by geography.

Recently Adopted Accounting Pronouncements

In August 2020, the Financial Accounting Standards Board, or FASB, issued Accounting Standards Update, or ASU, 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, which simplifies the accounting for certain financial instruments with characteristics of liabilities and equity, including convertible instruments and contracts in an entity's own equity. Specifically, ASU 2020-06 simplifies accounting for the issuance of convertible instruments by removing certain separation models required under existing guidance. In addition, the standard removes certain settlement conditions that are required for equity contracts to qualify for the derivative scope exception and requires use of the "if-converted" method when calculating the dilutive impact of convertible debt on earnings per share, or EPS. ASU 2020-06 is effective for financial statements issued for fiscal years beginning after December 15, 2021, and interim periods within those fiscal years, with early adoption permitted. We adopted the new standard on January 1, 2022 and there was no impact on the date of adoption. During the third quarter of 2022, we issued convertible notes as described in Note 10, Convertible Debt.

3. NET PRODUCT REVENUES

Net product revenues consist of the following:

(In thousands)	Year Ended December 31, 2022	2021	2020
ONPATTRO			
United States	$ 246,748	$ 213,210	$ 151,574
Europe	224,063	190,435	107,755
Rest of World	86,797	71,092	46,752
Total	557,608	474,737	306,081
AMVUTTRA			
United States	82,521	—	—
Europe	4,214	—	—
Rest of World	7,060	—	—
Total	93,795	—	—
GIVLAARI			
United States	115,659	92,747	42,797
Europe	48,670	30,895	12,000
Rest of World	8,815	4,173	309
Total	173,144	127,815	55,106
OXLUMO			
United States	27,698	18,876	—
Europe	37,915	38,949	333
Rest of World	4,169	1,761	—
Total	69,782	59,586	333
Total net product revenues	$ 894,329	$ 662,138	$ 361,520

As of December 31, 2022 and 2021, net product revenue-related receivables of $203.8 million and $124.9 million, respectively, were included in “Accounts receivable, net.”

The following table summarizes balances and activity in each product revenue allowance and reserve category:

(In thousands)	As of December 31, 2022 Chargebacks and Rebates	Trade Discounts and Allowances	Returns Reserve and Other Incentives	Total
Beginning balance	$ 120,682	$ 522	$ 10,112	$ 131,316
Provision related to current period sales	245,236	13,085	15,249	273,570
Credit or payments made during the period for current year sales	(108,185)	(10,310)	(9,850)	(128,345)
Credit or payments made during the period for prior year sales	(65,961)	(847)	(735)	(67,543)
Total	$ 191,772	$ 2,450	$ 14,776	$ 208,998

(In thousands)	As of December 31, 2021			
	Chargebacks and Rebates	Trade Discounts and Allowances	Returns Reserve and Other Incentives	Total
Beginning balance	$ 90,705	$ 639	$ 3,763	$ 95,107
Provision related to current period sales	167,691	8,064	12,223	187,978
Credit or payments made during the period for current year sales	(75,073)	(7,665)	(5,190)	(87,928)
Credit or payments made during the period for prior period sales	(62,641)	(516)	(684)	(63,841)
Total	$ 120,682	$ 522	$ 10,112	$ 131,316

During the years ended December 31, 2022 and 2021, we paid $44.3 million and $56.4 million, respectively, attributed to the pricing and reimbursement for the sale of our commercial products in France.

4. NET REVENUES FROM COLLABORATIONS

Net revenues from collaborations consist of the following:

(In thousands)	Year Ended December 31,		
	2022	2021	2020
Regeneron Pharmaceuticals	$ 87,844	$ 113,226	$ 74,072
Novartis AG	43,159	49,120	22,208
Vir Biotechnology	1,755	16,897	31,396
Other	2,154	1,710	3,657
Total	$ 134,912	$ 180,953	$ 131,333

The following table presents the balance of our receivables and contract liabilities related to our collaboration agreements:

(In thousands)	As of December 31,	
	2022	2021
Receivables included in "Accounts receivable, net"	$ 32,342	$ 73,266
Contract liabilities included in "Deferred revenue"	$ 235,528	$ 88,627

We recognized revenue of $55.5 million and $62.9 million in the years ended December 31, 2022 and 2021, respectively, that was included in the contract liability balance at the beginning of the period.

In order to determine revenue recognized in the period from contract liabilities, we first allocate revenue to the individual contract liability balance outstanding at the beginning of the period until the revenue exceeds that balance. If additional consideration is received on those contracts in subsequent periods, we assume all revenue recognized in the reporting period first applies to the beginning contract liability as opposed to a portion applying to the new consideration for the period.

The following table provides research and development expenses incurred by type, for which we recognize net revenue, that are directly attributable to our collaboration agreements, by collaboration partner:

(In thousands)	Year Ended December 31,								
	2022			2021			2020		
	Clinical Trial and Manufacturing	External Services	Other	Clinical Trial and Manufacturing	External Services	Other	Clinical Trial and Manufacturing	External Services	Other
Regeneron	$ 12,926	$ 2,141	$ 27,935	$ 24,989	$ 840	$ 47,582	$ 13,302	$ 171	$ 44,360
Other	156	679	337	10,311	775	4,489	20,113	765	14,422
Total	$ 13,082	$ 2,820	$ 28,272	$ 35,300	$ 1,615	$ 52,071	$ 33,415	$ 936	$ 58,782

The research and development expenses incurred for the agreements included in the table above consist of costs incurred for (i) clinical expenses, including manufacturing of clinical product, (ii) external services including consulting services and lab supplies and services, and (iii) other expenses, including professional services, facilities and overhead allocations, and a

reasonable estimate of compensation and related costs as billed to our counterparties, for which we recognize net revenues from collaborations. For the years ended December 31, 2022, 2021 and 2020, we did not incur material selling, general and administrative expenses related to our collaboration agreements.

In addition, we recognized a reduction to our research and development expenses of $16.9 million, $17.1 million, and $11.1 million for the years ended December 31, 2022, 2021 and 2020, respectively, from cost reimbursement due under certain of our collaboration agreements with Regeneron Pharmaceuticals, Inc., or Regeneron, accounted for under Accounting Standards Codification, or ASC, Topic 808, Collaborative Arrangements, or ASC 808.

Product Alliances

Regeneron Pharmaceuticals, Inc.

In April 2019, we entered into a global, strategic collaboration with Regeneron to discover, develop and commercialize RNAi therapeutics for a broad range of diseases by addressing therapeutic targets expressed in the eye and central nervous system, or CNS, in addition to a select number of targets expressed in the liver, which we refer to as the Regeneron Collaboration. The Regeneron Collaboration is governed by a Master Agreement, referred to as the Regeneron Master Agreement, which became effective on May 21, 2019. In connection with the Regeneron Master Agreement, we and Regeneron entered into (i) a binding co-co collaboration term sheet covering the continued development of cemdisiran, our C5 small interfering RNA, or siRNA, currently in Phase 2 development for C5 complement-mediated diseases, as a monotherapy and (ii) a binding license term sheet to evaluate anti-C5 antibody-siRNA combinations for C5 complement-mediated diseases including evaluating the combination of Regeneron's pozelimab (REGN3918), currently in Phase 3 development, and cemdisiran. The C5 co-co collaboration and license agreements were executed in August 2019.

Under the terms of the Regeneron Collaboration, we are working exclusively with Regeneron to discover RNAi therapeutics for eye and CNS diseases for an initial research period of approximately five years, which we refer to as the Initial Research Term. Regeneron has an option to extend the Initial Research Term (referred to as the Research Term Extension Period, and together with the Initial Research Term, the Research Term) for up to an additional five years, for a research term extension fee of up to $400.0 million. The Regeneron Collaboration also covers a select number of RNAi therapeutic programs designed to target genes expressed in the liver, including our previously announced collaboration with Regeneron to identify RNAi therapeutics for the chronic liver disease nonalcoholic steatohepatitis. We retain broad global rights to all of our other unpartnered liver-directed clinical and pre-clinical pipeline programs. The Regeneron Collaboration is governed by a joint steering committee that is comprised of an equal number of representatives from each party.

Regeneron leads development and commercialization for all programs targeting eye diseases (subject to limited exceptions), entitling us to certain potential milestone and royalty payments pursuant to the terms of a license agreement, the form of which has been agreed upon by the parties. We and Regeneron are alternating leadership on CNS and liver programs covered by the Regeneron Collaboration, with the lead party retaining global development and commercial responsibility. For such CNS and liver programs, both we and Regeneron have the option at lead candidate selection to enter into a co-co collaboration agreement, the form of which has been agreed upon by the parties, whereby both companies will share equally all costs of, and profits from, all development and commercialization activities under the program. If the non-lead party elects to not enter into a co-co collaboration agreement with respect to a given CNS or liver program, we and Regeneron will enter into a license agreement with respect to such program and the lead party will be the "Licensee" for the purposes of the license agreement. If the lead party for a CNS or liver program elects to not enter into the co-co collaboration agreement, then we and Regeneron will enter into a license agreement with respect to such program and leadership of the program will transfer to the other party and the former non-lead party will be the "Licensee" for the purposes of the license agreement.

With respect to the programs directed to C5 complement-mediated diseases, we retain control of cemdisiran monotherapy development, and Regeneron is leading combination product development. Pursuant to the C5 co-co collaboration agreement, Regeneron notified us in November 2022 of its decision to exercise its right to opt-out of the further development and commercialization of cemdisiran monotherapy. As a result, Regeneron no longer shares costs and potential future profits on any monotherapy program with us. We continue to perform our obligations under the agreement and we are solely responsible for all development and commercialization costs. Regeneron will be eligible to receive tiered double-digit royalties on net sales. Under the C5 license agreement, for cemdisiran to be used as part of a combination product, Regeneron is solely responsible for all development and commercialization costs and we will receive low double-digit royalties and commercial milestones of up to $325.0 million on any potential combination product sales. The C5 co-co collaboration agreement, the C5 license agreement, and the Master Agreement have been combined for accounting purposes and treated as a single agreement.

In connection with the Regeneron Master Agreement, Regeneron made an upfront payment of $400.0 million. We are also eligible to receive up to an additional $200.0 million in milestone payments upon achievement of certain criteria during early clinical development for eye and CNS programs. We and Regeneron plan to advance programs directed to up to 30 targets in the first five years under the Regeneron Collaboration during the Initial Research Term. For each program, Regeneron will provide us with $2.5 million in funding at program initiation and an additional $2.5 million at lead candidate identification, with

the potential for approximately $30.0 million in annual discovery funding to us as the Regeneron Collaboration reaches steady state.

Regeneron has the right to terminate the Regeneron Master Agreement for convenience upon ninety days' notice. The termination of the Regeneron Master Agreement does not affect the term of any license agreement or co-co collaboration agreement then in effect. In addition, either party may terminate the Regeneron Master Agreement for a material breach by, or insolvency of, the other party. Unless earlier terminated pursuant to its terms, the Regeneron Master Agreement will remain in effect with respect to each program until (a) such program becomes a terminated program or (b) the parties enter into a license agreement or co-co collaboration agreement with respect to such program. The Regeneron Master Agreement includes various representations, warranties, covenants, dispute escalation and resolution mechanisms, indemnities and other provisions customary for transactions of this nature.

For any license agreement subsequently entered into, the licensee will generally be responsible for its own costs and expenses incurred in connection with the development and commercialization of the collaboration products. The licensee will pay to the licensor certain development and/or commercialization milestone payments totaling up to $150.0 million for each collaboration product. In addition, following the first commercial sale of the applicable collaboration product under a license agreement, the licensee is required to make certain tiered royalty payments, ranging from low double-digits up to 20%, to the licensor based on the aggregate annual net sales of the collaboration product, subject to customary reductions.

For any co-co collaboration agreement subsequently entered into, we and Regeneron will share equally all costs of, and profits from, development and commercialization activities. Reimbursement of our share of costs will be recognized as a reduction to research and development expense in the consolidated statements of operations and comprehensive loss. In the event that a party exercises its opt-out right, the lead party will be responsible for all costs and expenses incurred in connection with the development and commercialization of the collaboration products under the applicable co-co collaboration agreement, subject to continued sharing of costs through defined points. If a party exercises its opt-out right, following the first commercial sale of the applicable collaboration product under a co-co collaboration agreement, the lead party is required to make certain tiered royalty payments, ranging from low double-digits up to 20%, to the other party based on the aggregate annual net sales of the collaboration product and the timing of the exercise of the opt-out right, subject to customary reductions and a reduction for opt-out transition costs.

Due to the uncertainty of pharmaceutical development and the high historical failure rates generally associated with drug development, we may not receive any milestone or royalty payments from Regeneron under the Regeneron Master Agreement, the C5 license agreement, or any future license agreement, or under any co-co collaboration agreement in the event we exercise our opt-out right.

Our obligations under the Regeneron Collaboration include: (i) a research license and research services, collectively referred to as the Research Services Obligation; (ii) a worldwide license to cemdisiran for combination therapies, and manufacturing and supply and development service obligations, collectively referred to as the C5 License Obligation; and (iii) development, manufacturing and commercialization activities for cemdisiran monotherapies, referred to as the C5 Co-Co Obligation.

The research license is not distinct from the research services primarily as a result of Regeneron being unable to benefit on its own or with other resources reasonably available, as the license is providing access to specialized expertise, particularly as it relates to RNAi technology that is not available in the marketplace. Similarly, the worldwide license to cemdisiran for combination therapies is not distinct from the manufacturing and supply and development service obligations, as Regeneron cannot benefit on its own from the value of the license without receipt of supply.

Separately, prior to Regeneron's decision in November 2022 to exercise its right to opt-out of the further development and commercialization of cemdisiran monotherapy, the cemdisiran monotherapy co-co collaboration agreement was under the scope of ASC 808 as we and Regeneron were both active participants in the development and manufacturing activities and were exposed to significant risks and rewards that were dependent on commercial success of the activities of the arrangement. Regeneron's decision to exercise its right to opt-out of the arrangement caused a change in the role of Regeneron and its exposure to significant risks and rewards under the arrangement. As a result, we determined that the arrangement no longer represents a collaborative arrangement.

The arrangement now represents a vendor-customer relationship under ASC 606 as we perform our obligation to provide development and manufacturing activities under the arrangement. The transaction price allocated to the C5 Co-Co obligation unit of account will be recognized over time using an input method based on cost incurred relative to the total estimated costs for the identified performance obligation by determining the proportion of effort incurred as a percentage of total effort we expect to expend.

The total transaction price is comprised of the $400.0 million upfront payment and additional variable consideration related to research, development, manufacturing and supply activities related to the Research Services Obligation and the C5 License Obligation. We utilized the expected value method to determine the amount of reimbursement for these activities. We

determined that any variable consideration related to sales-based royalties and milestones related to the worldwide license to cemdisiran for combination therapies is deemed to be constrained and therefore has been excluded from the transaction price. In addition, we are eligible to receive future milestones upon the achievement of certain criteria during early clinical development for the eye and CNS programs. We are also eligible to receive royalties on future commercial sales for certain eye, CNS or liver targets, if any; however, these amounts are excluded from variable consideration under the Regeneron Collaboration as we are only eligible to receive such amounts if, after a drug candidate is identified, the form of license agreement is subsequently executed resulting in a license that is granted to Regeneron. Any such subsequently granted license would represent a separate transaction under ASC 606.

We allocated the initial transaction price to each unit of account based on the applicable accounting guidance as follows, in thousands:

Performance Obligations	Standalone Selling Price	Transaction Price Allocated	Accounting Guidance
Research Services Obligation	$ 130,700	$ 183,100	ASC 606
C5 License Obligation	$ 97,600	92,500	ASC 606
C5 Co-Co Obligation	$ 364,600	246,000	ASC 606
		$ 521,600	

The transaction price was allocated to the obligations based on the relative estimated standalone selling prices of each obligation, over which management has applied significant judgment. We developed the estimated standalone selling price for the licenses included in the Research Services Obligation and the C5 License Obligation primarily based on the probability-weighted present value of expected future cash flows associated with each license related to each specific program. In developing such estimate, we applied judgment in the determination of the forecasted revenues, taking into consideration the applicable market conditions and relevant entity-specific factors, the expected number of targets or indications expected to be pursued under each license, the probability of success, the time needed to develop a product candidate pursuant to the associated license and the discount rate. We developed the estimated standalone selling price for the services and/or manufacturing and supply included in each of the obligations, as applicable, primarily based on the nature of the services to be performed and/or goods to be manufactured and estimates of the associated costs. The estimated standalone selling price of the C5 Co-Co Obligation was developed by estimating the present value of expected future cash flows that Regeneron is entitled to receive. In developing such estimate, we applied judgment in determining the indications that will be pursued, the forecasted revenues for such indications, the probability of success and the discount rate.

For the Research Services Obligation and the C5 License Obligation accounted for under ASC 606, we measure proportional performance over time using an input method based on cost incurred relative to the total estimated costs for each of the identified obligations, on a quarterly basis, by determining the proportion of effort incurred as a percentage of total effort we expect to expend. This ratio is applied to the transaction price allocated to each obligation. Management has applied significant judgment in the process of developing our estimates. Any changes to these estimates will be recognized in the period in which they change as a cumulative catch up. We re-evaluate the transaction price as of the end of each reporting period and as of December 31, 2022, the total transaction price was determined to be $558.9 million, an increase of $20.5 million from December 31, 2021. As of December 31, 2022, the transaction price is comprised of the upfront payment and variable consideration related to development, manufacture and supply activities. For the C5 Co-Co Obligation accounted for under ASC 808, the transaction price allocated to this obligation is recognized using a proportional performance method. Revenue recognized under this agreement, inclusive of the amount allocated to the C5 Co-Co Obligation, is accounted for as collaboration revenue.

The following tables provide a summary of the transaction price allocated to each unit of account based on the applicable accounting guidance, in addition to revenue activity during the period, in thousands:

Performance Obligations	Transaction Price Allocated As of December 31, 2022	Deferred Revenue As of December 31, 2022	Deferred Revenue As of December 31, 2021	Accounting Guidance
Research Services Obligation	$ 215,680	$ 26,200	$ 42,300	ASC 606
C5 License Obligation	97,200	7,000	26,900	ASC 606
C5 Co-Co Obligation	246,000	193,600	212,500	ASC 606
Total	$ 558,880	$ 226,800	$ 281,700	

Performance Obligations	Revenue Recognized During Year Ended December 31, 2022	Year Ended December 31, 2021	Year Ended December 31, 2020	Accounting Guidance
Research Services Obligation	$ 28,600	$ 37,600	$ 44,800	ASC 606
C5 License Obligation	32,500	44,600	7,100	ASC 606
C5 Co-Co Obligation	20,080	18,900	11,700	ASC 606
Total	$ 81,180	$ 101,100	$ 63,600	

As of December 31, 2022, the aggregate amount of the transaction price allocated to the remaining Research Services Obligation, C5 License Obligation and C5 Co-Co Obligation that was unsatisfied was $289.1 million, which is expected to be recognized through the term of the Regeneron Collaboration as the services are performed. Deferred revenue related to the Regeneron Collaboration is classified as either current or non-current in the consolidated balance sheets based on the period the revenue is expected to be recognized.

Novartis AG

2013 Collaboration with The Medicines Company

In February 2013, we and The Medicines Company, or MDCO, entered into a license and collaboration agreement pursuant to which we granted to MDCO an exclusive, worldwide license to develop, manufacture and commercialize RNAi therapeutics targeting proprotein convertase subtilisin/kexin type 9, or PCSK9, for the treatment of hypercholesterolemia and other human diseases, including inclisiran. We refer to this agreement, as amended through the date hereof, as the MDCO License Agreement. On January 6, 2020, Novartis AG, or Novartis, completed its acquisition of MDCO and assumed all rights and obligations under the MDCO License Agreement.

As of December 31, 2022, we have earned $80.0 million of milestones and upon achievement of certain events, we will be entitled to receive additional milestones, up to an aggregate of $100.0 million, including $90.0 million in specified commercialization milestones and $10.0 million in other specified regulatory milestones. In addition, we are entitled to royalties ranging from 10% up to 20% based on annual worldwide net sales of licensed products by Novartis, its affiliates and sublicensees, subject to reduction under specified circumstances. Due to the uncertainty of pharmaceutical development and the high historical failure rates generally associated with drug development, we may not receive any additional milestone payments under the MDCO License Agreement and future royalty payments may be less than anticipated.

Unless terminated earlier in accordance with the terms of the agreement, the MDCO License Agreement expires on a licensed product-by-licensed product and country-by-country basis upon expiration of the last royalty term for any licensed product in any country, where a royalty term is defined as the latest to occur of (1) the expiration of the last valid claim of patent rights covering a licensed product, (2) the expiration of the Regulatory Exclusivity, as defined in the MDCO License Agreement, and (3) the twelfth anniversary of the first commercial sale of the licensed product in such country. We estimate that our core technology patents covering licensed products under the MDCO License Agreement will expire in most countries by 2029. We also estimate that our Leqvio (inclisiran) product-specific patents covering licensed products under the MDCO License Agreement will expire in the U.S. and Europe between 2027 and 2036, inclusive of any patent term extensions and/or any supplementary protection certificates extending such terms due to regulatory delay in those countries where such extensions are available. In addition, more patent filings relating to the collaboration may be made in the future.

Either party may terminate the MDCO License Agreement in the event the other party fails to cure a material breach or upon patent-related challenges by the other party. In addition, Novartis has the right to terminate the agreement without cause at any time upon four months' prior written notice.

During the term of the MDCO License Agreement, neither party will, alone or with an affiliate or third party, research, develop or commercialize, or grant a license to any third party to research, develop or commercialize, in any country, any

product (for Alnylam) and any siRNA product (for Novartis) directed to the PCSK9 gene, other than a licensed product, without the prior written agreement of the other party, subject to the terms of the MDCO License Agreement.

We evaluated the MDCO License Agreement and concluded that Novartis meets the definition of a customer and that the MDCO License Agreement is a contract. We determined the transaction price, identified the performance obligations and allocated the transaction price to each performance obligation. We also determined that substantially all of our performance obligations are within the scope of the revenue standard as they relate to the delivery of goods and services to a customer for that customer's use in monetizing an asset. Specifically, we concluded that Novartis meets the definition of a customer as we are delivering intellectual property and know-how rights as well as research and development activities. In addition, we determined that the MDCO License Agreement met the requirements to be accounted for as a contract, including that it is probable that we will collect the consideration to which we are entitled in exchange for the goods or services that will be delivered to Novartis. We determined that, pursuant to ASC 606, the performance obligations were not separately identifiable and were not distinct (and did not have standalone value) due to the specialized nature of the services to be provided by us and the dependent relationship between the performance obligations. Given this fact pattern, we have concluded the MDCO License Agreement has a single identified or combined performance obligation.

None of the unearned milestones are included in the transaction price, as all unearned milestone amounts are not considered likely of achievement and therefore constrained. We considered several factors, including that achievement of the milestones is outside our control and contingent upon success in regulatory decisions. Any consideration related to sales-based royalties (including milestones) will be recognized when the related sales occur as they were determined to relate predominantly to the license granted to MDCO and as a result have also been excluded from the transaction price. During 2018, we completed the performance obligations identified in the MDCO License Agreement, including the supply and technical transfer agreement, however, we continue to receive additional orders for supply of certain material. We consider such orders as promised goods to be distinct from the other performance obligations since Novartis now has the ability to manufacture on its own through its own vendors. Such orders will be treated as separate agreements and any associated revenue will be recognized upon transfer of control.

Novartis License Agreement

In December 2021, we and Novartis entered into a collaboration and license agreement, or the Novartis License Agreement, pursuant to which we granted to Novartis an exclusive, worldwide license to develop, manufacture and commercialize siRNAs targeting end-stage liver disease, or ESLD, potentially leading to the development of a treatment designed to promote the regrowth of functional liver cells and to provide an alternative to transplantation for patients with liver failure.

Pursuant to the Novartis License Agreement, we received an upfront fee of $12.5 million. We may also receive milestone payments upon the achievement of certain development, regulatory and commercial milestones, as well as royalties on the net sales of licensed products ranging from high-single-digit to sub-teen double-digit percentages. Due to the uncertainty of pharmaceutical development and the high historical failure rates generally associated with drug development, we may not receive any milestone or royalty payments under the Novartis License Agreement.

Under the Novartis License Agreement, we are developing and testing potential siRNAs using target-specific assays developed by Novartis pursuant to an agreed upon research plan for a specified period referred to as the Collaboration Term. Novartis will reimburse us for the cost of our activities under the research plan, referred to as the DC Workplan, subject to an agreed upon cap. Once a lead candidate is identified, further development and clinical research will be conducted by Novartis. The collaboration is governed by a joint steering committee comprised of an equal number of representatives from each party.

Unless terminated earlier in accordance with the terms of the Novartis License Agreement, the Collaboration Term expires at the earlier of (1) 180 days after completion of the development activities assigned to us as agreed upon between the parties, or (2) December 17, 2024.

Either party may terminate the Novartis License Agreement in the event the other party fails to cure a material breach or upon patent-related challenges by the other party. In addition, Novartis has the right to terminate the agreement without cause at any time upon three months' prior written notice.

During the term of the Novartis License Agreement, neither party will, alone or with an affiliate or third party, research, develop or commercialize, or grant a license to any third party to research, develop or commercialize, in any country, any siRNA product directed to a liver target identified by Novartis, other than a licensed product, without the prior written agreement of the other party, subject to the terms of the Novartis License Agreement.

We identified one performance obligation under the Novartis License Agreement comprised of: i) the exclusive license to develop, manufacture and commercialize siRNAs targeting ESLD; and ii) the obligation to perform work under the DC Workplan. The license is not distinct from the services, including the obligation to deliver development candidates, as Novartis cannot benefit on its own from the value of the license without receipt of such services. We measure proportional performance over time using an input method based on cost incurred relative to the total estimated costs for the identified performance

obligation, on a quarterly basis, by determining the proportion of effort incurred as a percentage of total effort we expect to expend. This ratio is applied to the total transaction price. Management has applied significant judgment in the process of developing our estimates. Any changes to these estimates will be recognized in the period in which they change as a cumulative catch up. As of December 31, 2022, the total transaction price was determined to be approximately $16.0 million, comprised of the $12.5 million upfront payment and estimated variable consideration attributed to work to be performed under the DC Workplan. We utilized the expected value method to determine the amount of reimbursement for these activities. The total transaction price is allocated entirely to the single performance obligation. We determined any variable consideration related to sales-based royalties and milestones related to the exclusive license to be constrained and therefore excluded such consideration from the transaction price.

As of December 31, 2022, the aggregate amount of the transaction price allocated to the performance obligation that was unsatisfied was $11.0 million, which is expected to be recognized through the term of the DC Workplan as the services are performed.

Vir Biotechnology, Inc.

In October 2017, we and Vir Biotechnology, Inc., or Vir, entered into a collaboration and license agreement, or the Vir Agreement, for the development and commercialization of RNAi therapeutics for infectious diseases, including chronic hepatitis B virus, or HBV, infection.

Pursuant to the Vir Agreement, we granted to Vir an exclusive license to develop, manufacture and commercialize ALN-HBV02 (VIR-2218), for all uses and purposes other than certain excluded fields, as set forth in the Vir Agreement. In addition, we granted Vir an exclusive option for up to four additional RNAi therapeutic programs for the treatment of infectious diseases. Under the terms of the Vir Agreement, for each product arising from the HBV program, including ALN-HBV02, we retained the right to opt into a profit-sharing arrangement prior to the start of a Phase 3 clinical trial. In addition, we have the right on a product-by-product basis with respect to each additional infectious disease program that Vir elects to pursue, to opt into a profit-sharing arrangement for each such product at any time during a specified period prior to the initiation of a Phase 3 clinical trial for each such product.

Under the Vir Agreement, we have earned and received certain upfront and development milestone payments in the form of cash ad Vir common stock, as well as sublicense revenue. We may receive additional milestone payments upon the achievement of certain development, regulatory and commercial milestones, as well as royalties on the net sales of licensed products ranging from high-single-digit to sub-teen double-digit percentages. Due to the uncertainty of pharmaceutical development and the high historical failure rates generally associated with drug development, we may not receive any additional milestone payments or any royalty payments under the Vir Agreement.

Unless terminated earlier in accordance with the terms of the agreement, the Vir Agreement expires on a licensed product-by-product and country-by-country basis upon expiration of all royalty payment obligations under the agreement. If Vir does not exercise its option for an infectious disease program, the Vir Agreement will expire upon the expiration of the applicable option period with respect to such program. However, if we exercise our profit-sharing option for any product, the term of the agreement will continue until the expiration of the profit-sharing arrangement for such product.

Either party may terminate the agreement in the event the other party fails to cure a material breach, or upon patent-related challenges by the other party. In addition, Vir has the right to terminate the agreement on a program-by-program basis or in its entirety for any reason on 90 days' written notice.

We identified one performance obligation under the Vir Agreement, as amended, comprised of: i) the exclusive license to develop, manufacture and commercialize RNAi therapeutics (including ALN-HBV02); and ii) the obligation to deliver four additional development candidates and supply product for each such RNAi therapeutic program. The license is not distinct from the services, including the obligation to deliver development candidates and supply product, as Vir cannot benefit on its own from the value of the license without receipt of such services and supply. We measure proportional performance over time using an input method based on cost incurred relative to the total estimated costs for the identified performance obligation, on a quarterly basis, by determining the proportion of effort incurred as a percentage of total effort we expect to expend. This ratio is applied to the total transaction price. Management has applied significant judgment in the process of developing our estimates. Any changes to these estimates will be recognized in the period in which they change as a cumulative catch up. As of December 31, 2022, the total transaction price was determined to be $111.0 million, comprised of the upfront payment, fair value of non-cash equity consideration at contract inception, milestones achieved, and variable consideration related to development, manufacture and supply activities. We utilized the expected value method to determine the amount of reimbursement for these activities. The total transaction price is allocated entirely to the single performance obligation. We determined any variable consideration related to sales-based royalties and milestones related to the exclusive license to be constrained and therefore excluded such consideration from the transaction price.

As of December 31, 2022, the aggregate amount of the transaction price allocated to the performance obligation that was unsatisfied was $36.3 million, which is expected to be recognized through the term of the Vir Agreement as the services are performed.

Other Strategic License Agreements

PeptiDream, Inc.

In July 2021, we entered into a license and collaboration agreement with PeptiDream, Inc., or PeptiDream, to discover and develop peptide-siRNA conjugates to create multiple opportunities to deliver RNAi therapeutics to tissues outside the liver. Through this collaboration, the companies will collaborate to select and optimize peptides for targeted delivery of small siRNA molecules to a wide range of cell types and tissues via specific interactions with receptors expressed on the target cells. Under the terms of the agreement, PeptiDream received an upfront payment from us of $10.0 million and we will provide research and development funding over the term of the research collaboration, according to the terms of the PeptiDream agreement. Due to the early stage of these assets, we recorded research and development expense for the upfront payment of $10.0 million during the third quarter of 2021. PeptiDream may also receive payments based on the achievement of specified development, regulatory, and commercial milestones potentially totaling up to $247.0 million for each product developed by us that utilizes PeptiDream's technology, as well as low-to-mid single digit royalties on sales, if any, of any such products.

5. LIABILITY RELATED TO THE SALE OF FUTURE ROYALTIES

In April 2020, we entered into a purchase and sale agreement, or Purchase Agreement, with BX Bodyguard Royalties L.P. (an affiliate of The Blackstone Group Inc.), or Blackstone Royalties, under which Blackstone Royalties acquired 50% of royalties payable, or Royalty Interest, with respect to net sales by MDCO, its affiliates or sublicensees of inclisiran (or the branded drug product, Leqvio) and any other licensed products under the MDCO License Agreement, and 75% of the commercial milestone payments payable under the MDCO License Agreement, together with the Royalty Interest, the Purchased Interest. If Blackstone Royalties does not receive payments in respect of the Royalty Interest by December 31, 2029, equaling at least $1.00 billion, Blackstone Royalties will receive 55% of the Royalty Interest beginning on January 1, 2030. In consideration for the sale of the Purchased Interest, Blackstone Royalties paid us $1.00 billion.

We continue to own or control all inclisiran intellectual property rights and are responsible for certain ongoing manufacturing and supply obligations related to the generation of the Purchased Interest. Due to our continuing involvement, we will continue to account for any royalties and commercial milestones due to us under the MDCO License Agreement as revenue on our consolidated statement of operations and comprehensive loss and record the proceeds from this transaction as a liability, net of closing costs, on our consolidated balance sheet.

In order to determine the amortization of the liability related to the sale of future royalties, we are required to estimate the total amount of future payments to Blackstone Royalties over the life of the Purchase Agreement. The $1.00 billion liability, recorded at execution of the agreement, will be accreted to the total of these royalty and commercial milestone payments as interest expense over the life of the Purchase Agreement. As of December 31, 2022, our estimate of this total interest expense resulted in an effective annual interest rate of 8%. These estimates contain assumptions that impact both the amount recorded at execution and the interest expense that will be recognized in future periods.

As payments are made to Blackstone Royalties, the balance of the liability will be effectively repaid over the life of the Purchase Agreement. The exact timing and amount of repayment is likely to change each reporting period. A significant increase or decrease in Leqvio global net revenue will materially impact the liability related to the sale of future royalties, interest expense and the time period for repayment. We will periodically assess the expected payments to Blackstone Royalties and to the extent the amount or timing of such payments is materially different than our initial estimates, we will prospectively adjust the amortization of the liability related to the sale of future royalties and the related interest expense.

As of December 31, 2022, the carrying value of the liability related to the sale of future royalties was $1.29 billion, net of closing costs of $10.8 million. The carrying value of the liability related to the sale of future royalties approximates fair value as of December 31, 2022 and is based on our current estimates of future royalties and commercial milestones expected to be paid to Blackstone Royalties over the life of the arrangement, which are considered Level 3 inputs.

The following table shows the activity with respect to the liability related to the sale of future royalties, in thousands:

Carrying value as of December 31, 2020	$	1,071,541
Interest expense recognized		116,940
Payments		(378)
Carrying value as of December 31, 2021		1,188,103
Interest expense recognized		107,601
Payments		(3,400)
Carrying value as of December 31, 2022	$	1,292,304

6. FAIR VALUE MEASUREMENTS

The following tables present information about our financial assets and liabilities that are measured at fair value on a recurring basis and indicate the fair value hierarchy of the valuation techniques we utilized to determine such fair value:

(In thousands)	As of December 31, 2022	Quoted Prices in Active Markets (Level 1)	Significant Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Financial assets				
Cash equivalents:				
Money market funds	$ 270,394	$ 270,394	$ —	$ —
U.S. treasury securities	44,817	—	44,817	—
U.S. government-sponsored enterprise securities	41,763	—	41,763	—
Commercial paper	22,350	—	22,350	—
Certificates of deposit	3,289	—	3,289	—
Corporate notes	1,024	—	1,024	—
Marketable debt securities:				
U.S. treasury securities	820,913	—	820,913	—
U.S. government-sponsored enterprise securities	230,770	—	230,770	—
Corporate notes	208,284	—	208,284	—
Commercial paper	36,793	—	36,793	—
Certificates of deposit	1,130	—	1,130	—
Marketable equity securities	28,122	28,122	—	—
Restricted cash (money market funds)	1,197	1,197	—	—
Total financial assets	$ 1,710,846	$ 299,713	$ 1,411,133	$ —
Financial liabilities				
Development derivative liability	$ 209,277	$ —	$ —	$ 209,277

(In thousands)	As of December 31, 2021	Quoted Prices in Active Markets (Level 1)	Significant Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Financial assets				
Cash equivalents:				
Money market funds	$ 255,869	$ 255,869	$ —	$ —
U.S. treasury securities	54,998	—	54,998	—
Marketable debt securities:				
U.S. treasury securities	1,030,578	—	1,030,578	—
Corporate notes	253,239	—	253,239	—
U.S. government-sponsored enterprise securities	177,741	—	177,741	—
Commercial paper	78,543	—	78,543	—
Certificates of deposit	7,501	—	7,501	—
Municipal securities	1,015	—	1,015	—
Marketable equity securities	66,972	66,972	—	—
Restricted cash (money market funds)	1,195	1,195	—	—
Total financial assets	$ 1,927,651	$ 324,036	$ 1,603,615	$ —
Financial liabilities				
Development derivative liability	$ 83,618	$ —	$ —	$ 83,618

For the years ended December 31, 2022 and 2021, there were no transfers between Level 1 and Level 2 financial assets. The carrying amounts reflected in our consolidated balance sheets for cash, accounts receivable, net, other current assets, accounts payable and accrued expenses approximate fair value due to their short-term maturities.

7. MARKETABLE DEBT SECURITIES

The following tables summarize our marketable debt securities:

	As of December 31, 2022			
(In thousands)	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Fair Value
U.S. treasury securities	$ 870,033	$ 79	$ (4,382)	$ 865,730
U.S. government-sponsored enterprise securities	275,610	24	(3,101)	272,533
Corporate notes	211,398	16	(2,106)	209,308
Commercial paper	59,143	—	—	59,143
Certificates of deposit	4,419	—	—	4,419
Total	$ 1,420,603	$ 119	$ (9,589)	$ 1,411,133

	As of December 31, 2021			
(In thousands)	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Fair Value
U.S. treasury securities	$ 1,086,232	$ 6	$ (662)	$ 1,085,576
Corporate notes	253,926	1	(688)	253,239
U.S. government-sponsored enterprise securities	178,027	2	(288)	177,741
Commercial paper	78,543	—	—	78,543
Certificates of deposit	7,501	—	—	7,501
Municipal securities	1,016	—	(1)	1,015
Total	$ 1,605,245	$ 9	$ (1,639)	$ 1,603,615

The fair values of our marketable debt securities by classification in the consolidated balance sheets were as follows:

(In thousands)	December 31, 2022	December 31, 2021
Cash and cash equivalents	$ 113,243	$ 54,998
Marketable debt securities	1,297,890	1,548,617
Total	$ 1,411,133	$ 1,603,615

8. OTHER BALANCE SHEET DETAILS

Inventory

The components of inventory are summarized as follows:

	As of December 31,	
(In thousands)	2022	2021
Raw materials	$ 22,315	$ 14,754
Work in process	113,783	100,942
Finished goods	25,606	7,005
Total inventory	$ 161,704	$ 122,701

As of December 31, 2022 and 2021, we had $32.7 million and $36.3 million of long-term inventory, respectively, included within other assets in our consolidated balance sheet as we anticipate it being consumed beyond our normal operating cycle. As of December 31, 2022 and 2021, we had $0.0 million and $7.1 million, respectively, of capitalized inventory produced for commercial sale for products awaiting regulatory approval.

Property, Plant and Equipment, Net

Property, plant and equipment, net consist of the following:

	As of December 31,	
(In thousands)	**2022**	**2021**
Buildings	$ 269,322	$ 262,637
Leasehold improvements	230,848	152,045
Construction in progress	14,595	80,753
Laboratory equipment	82,586	61,351
Manufacturing equipment	45,311	43,739
Computer equipment and software	33,370	21,885
Furniture and fixtures	11,832	10,883
Land	9,080	9,080
	696,944	642,373
Less: accumulated depreciation	(173,450)	(140,415)
Total	$ 523,494	$ 501,958

Accrued Expenses

Accrued expenses consist of the following:

	As of December 31,	
(In thousands)	**2022**	**2021**
Product rebates and discounts	$ 208,998	$ 131,279
Compensation and related	130,690	93,583
Pre-clinical, clinical trial and manufacturing	94,702	83,534
Licensing and collaboration agreements	31,680	22,843
Consulting and professional services	19,848	17,784
Other	59,542	46,151
Total	$ 545,460	$ 395,174

Cash, Cash Equivalents and Restricted Cash

The following table provides a reconciliation of cash, cash equivalents and restricted cash reported within our consolidated balance sheets that sum to the total of these amounts shown in the consolidated statements of cash flows:

	As of December 31,		
(In thousands)	**2022**	**2021**	**2020**
Cash and cash equivalents	$ 866,394	$ 819,975	$ 496,580
Total restricted cash included in other assets	2,162	2,178	2,466
Total cash, cash equivalents, and restricted cash shown in the consolidated statements of cash flows	$ 868,556	$ 822,153	$ 499,046

Accumulated Other Comprehensive (Loss) Income

The following table summarizes the changes in accumulated other comprehensive (loss) income, by component:

(In thousands)	Loss on Investment in Joint Venture	Defined Benefit Pension Plans, Net of Tax	Unrealized Gains (Losses) from Debt Securities	Foreign Currency Translation Adjustment	Total Accumulated Other Comprehensive (Loss) Income
Balance as of December 31, 2020	$ (32,792)	$ (3,754)	$ 348	$ (7,424)	$ (43,622)
Other comprehensive loss before reclassifications	—	899	—	11,398	12,297
Amounts reclassified from other comprehensive income	—	44	(1,978)	—	(1,934)
Net other comprehensive income (loss)	—	943	(1,978)	11,398	10,363
Balance as of December 31, 2021	(32,792)	(2,811)	(1,630)	3,974	(33,259)
Other comprehensive income before reclassifications	—	—	11	(5,274)	(5,263)
Amounts reclassified from other comprehensive income	—	1,719	(7,851)	—	(6,132)
Net other comprehensive income (loss)	—	1,719	(7,840)	(5,274)	(11,395)
Balance as of December 31, 2022	$ (32,792)	$ (1,092)	$ (9,470)	$ (1,300)	$ (44,654)

9. CREDIT AGREEMENT

In April 2020, we entered into a credit agreement, or Credit Agreement, among us, certain of our subsidiaries (such subsidiaries, together with us, the Loan Parties), funds or accounts managed or advised by GSO Capital Partners LP (now Blackstone Alternative Credit Advisors LP) and certain other affiliates of The Blackstone Group Inc., and the other lenders from time to time parties thereto, collectively, the Lenders, and Wilmington Trust, National Association, as the administrative agent for the Lenders. The Credit Agreement provided for a senior secured delayed draw term loan facility, referred to as the Term Loans, which consisted of three tranches providing funding of $700.0 million. In September 2022, we extinguished the Term Loans and paid all outstanding balances, including principal of $700.0 million and prepayment premiums of $62.1 million and terminated the Credit Agreement. Upon termination, we recorded a $76.6 million loss on the extinguishment of the debt.

The Term Loans were set to mature in December 2027. During the period the Term Loans were outstanding, we had elected a LIBOR Rate plus 7%, and paid $17.5 million in total funding fees in connection with such Term Loans. Our interest rate was 9% and 8% as of June 30, 2022 and December 31, 2021, respectively.

10. CONVERTIBLE DEBT

Convertible Senior Notes Due 2027

On September 12, 2022, we commenced a private offering of $900.0 million in aggregate principal amount of 1% Convertible Senior Notes due 2027, or the Initial Notes. On September 13, 2022, the initial purchasers in such offering exercised their option to purchase an additional $135.0 million in aggregate principal amount of our 1% Convertible Senior Notes due 2027, or the Additional Notes, and together with the Initial Notes collectively referred to as the Notes, bringing the total aggregate principal amount of the Notes to $1.04 billion. The Notes were issued pursuant to an indenture, dated September 15, 2022, or the Indenture. The Indenture includes customary covenants and sets forth certain events of default after which the Notes may be declared immediately due and payable and sets forth certain types of bankruptcy or insolvency events of default involving the Company after which the Notes become automatically due and payable.

The Notes will mature on September 15, 2027, unless earlier converted, redeemed or repurchased. The Notes will bear interest from September 15, 2022 at a rate of 1% per year payable semiannually in arrears on March 15 and September 15 of each year, beginning on March 15, 2023. The Notes are convertible at the option of the noteholder on or after June 15, 2027. Prior to June 15, 2027, the Notes are convertible only under the following circumstances: (1) During any calendar quarter commencing after the calendar quarter ending on December 31, 2022 (and only during such calendar quarter), if the last reported sale price of our common stock for at least 20 trading days (whether or not consecutive) during a period of 30 consecutive trading days ending on, and including, the last trading day of the immediately preceding calendar quarter is greater than or equal to 130% of the conversion price on each applicable trading day; (2) During the five business day period after any ten consecutive trading day period in which the trading price per $1,000 principal amount of the Notes for each trading day of that ten consecutive trading day period was less than 98% of the product of the last reported sale price of our common stock and

the conversion rate of the Notes on such trading day; (3) If we call any or all of the Notes for redemption; or (4) Upon the occurrence of specific corporate events as set forth in the Indenture governing the Notes. We will settle any conversions of Notes by paying or delivering, as applicable, cash, shares of our common stock, or a combination of cash and shares of common stock, at our election.

The conversion rate for the Notes will initially be 3.4941 shares of common stock per $1,000 principal amount of Notes, which is equivalent to an initial conversion price of approximately $286.20 per share of common stock. The initial conversion price of the Notes represents a premium of approximately 35% over the $212.00 per share last reported sale price of common stock on September 12, 2022. The conversion rate is subject to adjustment under certain circumstances in accordance with the terms of the Indenture.

We may not redeem the Notes prior to September 20, 2025. We may redeem for cash equal to 100% of the principal amount of the Notes being redeemed plus accrued and unpaid interest all or any portion of the Notes, at our option, on or after September 20, 2025, if the last reported sales price of our common stock has been at least 130% of the conversion price then in effect for at least 20 trading days (whether or not consecutive) during any 30 consecutive trading day period. No sinking fund is provided for the Notes and therefore we are not required to redeem or retire the Notes periodically.

If we undergo a fundamental change, as defined in the indenture agreement, then subject to certain conditions, holders may require us to repurchase for cash all or any portion of their Notes at a fundamental change repurchase price equal to 100% of the principal amount of the Notes to be repurchased plus accrued and unpaid interest. In addition, if specific corporate events occur prior to the maturity date or if we issue a notice of redemption, we will increase the conversion rate by pre-defined amounts for holders who elect to convert their notes in connection with such a corporate event. The conditions allowing holders of the Notes to convert were not met this quarter.

As of December 31, 2022, the Notes are classified as a long-term liability, net of issuance costs of $19.2 million, on the consolidated balance sheets. As of December 31, 2022, the estimated fair value of the Notes was approximately $1.12 billion. The fair value was determined based on the last actively traded price per $100 of the Notes for the period ended December 31, 2022 (Level 2). Interest expense recognized related to the Notes for the twelve months ended December 31, 2022 was $3.0 million. The Notes were issued at par and costs associated with the issuance of the Notes are amortized to interest expense over the contractual term of the Notes. As of December 31, 2022, the effective interest rate of the Notes is 1%.

Capped Call Transactions

In September 2022, in connection with the pricing of the Initial Notes and the initial purchasers' exercise of their option to purchase the Additional Notes, we entered into privately negotiated capped call transactions, or Capped Call Transactions. The Capped Call Transactions initially cover, subject to customary anti-dilution adjustments, the number of shares of common stock that underlie the Notes. The cap price of the Capped Call Transactions is initially $424.00 per share, which represents a premium of 100% over the last reported sale price of common stock of $212.00 per share on September 12, 2022, and is subject to certain adjustments under the terms of the capped call transactions. We used approximately $118.6 million of the proceeds from the offering of Notes to pay the cost of the Capped Call Transactions.

We evaluated the Capped Call Transactions and determined that they should be accounted for separately from the Notes. The cost of $118.6 million to purchase the Capped Call Transactions was recorded as a reduction to additional paid-in capital in the consolidated balance sheet as of December 31, 2022 as the Capped Call Transactions are indexed to our own stock and met the criteria to be classified in stockholders' equity.

11. DEVELOPMENT DERIVATIVE LIABILITY

In August 2020, we entered into a co-development agreement, referred to as the Funding Agreement, with BXLS V Bodyguard – PCP L.P. and BXLS Family Investment Partnership V – ESC L.P., collectively referred to as Blackstone Life Sciences, pursuant to which Blackstone Life Sciences will provide up to $150.0 million in funding for the clinical development of vutrisiran and zilebesiran, two of our cardiometabolic programs. With respect to vutrisiran, Blackstone Life Sciences has committed to provide up to $70.0 million to fund development costs related to the HELIOS-B Phase 3 clinical trial. In November 2021, Blackstone Life Sciences opted in to Phase 2 clinical trial funding of zilebesiran, committing to fund, upon meeting certain patient enrollment thresholds, up to $26.0 million. Furthermore, Blackstone Life Sciences has the right, but is not obligated, to fund up to $54.0 million for development costs related to a Phase 3 clinical trial of zilebesiran. The amount of funding ultimately provided by Blackstone Life Sciences is dependent on us achieving specified development milestones with respect to each clinical trial. We retain sole responsibility for the development and commercialization of both vutrisiran and zilebesiran.

As consideration for Blackstone Life Sciences' funding for vutrisiran clinical development costs, we have agreed to pay Blackstone Life Sciences a 1% royalty on net sales of AMVUTTRA (vutrisiran) for a 10-year term beginning upon the first commercial sale following regulatory approval of vutrisiran for ATTR-cardiomyopathy, as well as fixed payments of up to 2.5 times their investment over a two-year period upon regulatory approval of vutrisiran for ATTR-cardiomyopathy in specified

countries, unless it is later withdrawn from the market following a mandatory recall. As consideration for Blackstone Life Sciences' funding for Phase 2 clinical development costs of zilebesiran, we have agreed to pay Blackstone Life Sciences fixed payments of up to 3.25 times their Phase 2 investment over a four-year period upon the successful completion of the zilebesiran Phase 2 clinical trial, unless certain regulatory events affecting the continued development of zilebesiran occur. As consideration for Blackstone Life Sciences' funding for Phase 3 clinical development costs of zilebesiran, we have agreed to pay Blackstone Life Sciences fixed payments of up to 4.5 times their Phase 3 investment over a four-year period upon regulatory approval of zilebesiran in specified countries, unless it is later withdrawn from the market following a mandatory recall.

Our payment obligations under the Funding Agreement will be secured, subject to certain exceptions, by security interests in intellectual property owned by us relating to vutrisiran and zilebesiran, as well as in our bank account in which the funding deposits will be made.

We and Blackstone Life Sciences each have the right to terminate the Funding Agreement in its entirety in the event of the other party's bankruptcy or similar proceedings. We and Blackstone Life Sciences may each terminate the Funding Agreement in its entirety or with respect to either product in the event of an uncured material breach by the other party, or with respect to a product for certain patient health and safety reasons, or if regulatory approval in specified major market countries is not obtained for the product following the completion of clinical trials for the product. In addition, Blackstone Life Sciences has the right to terminate the Funding Agreement in its entirety upon the occurrence of certain events affecting our ability to make payments under the agreement or to develop or commercialize the products, or upon a change of control of us. Blackstone Life Sciences may also terminate the Funding Agreement with respect to a product if the joint steering committee elects to terminate the development program for that product in its entirety, if certain clinical endpoints are not achieved for that product or, with respect to vutrisiran only, if our right to develop or commercialize vutrisiran is enjoined in a specified major market as a result of an alleged patent infringement. In certain termination circumstances, we will be obligated to pay Blackstone Life Sciences an amount that is equal to, or a multiplier of, the development funding received from Blackstone Life Sciences, and we may remain obligated under certain circumstances to make the payments to Blackstone Life Sciences described above, or the royalty described above in the case of AMVUTTRA, should we obtain regulatory approval for zilebesiran or for vutrisiran for ATTR-cardiomyopathy following termination.

We account for the Funding Agreement under ASC Topic 815, Derivatives and Hedging, as a derivative liability, measured at fair value, within other liabilities on our consolidated balance sheets. The change in fair value due to the remeasurement of the development derivative liability is recorded as other expense on our consolidated statements of operations and comprehensive loss.

As of December 31, 2022 and 2021, the derivative liability is classified as a Level 3 financial liability in the fair value hierarchy. The valuation method incorporates certain unobservable Level 3 key inputs including (i) the probability and timing of achieving stated development milestones to receive payments from Blackstone Life Sciences, (ii) the probability and timing of achieving regulatory approval and payments to Blackstone Life Sciences, (iii) an estimate of the amount and timing of the royalty payable on net sales of AMVUTTRA, assuming regulatory approval for ATTR-cardiomyopathy, (iv) our cost of borrowing (12%), and (v) Blackstone Life Sciences' cost of borrowing (4%).

The following table presents the activity with respect to the development derivative liability, in thousands:

Carrying value as of December 31, 2020	$	25,585
Amount received under the Funding Agreement		19,600
Loss recorded from remeasurement		38,433
Carrying value as of December 31, 2021		83,618
Amount received under the Funding Agreement		31,000
Loss recorded from remeasurement		94,659
Carrying value as of December 31, 2022	$	209,277

12. STOCK-BASED COMPENSATION

Stock Plans

In May 2020, our stockholders approved a second amendment to our 2018 Stock Incentive Plan, as amended, to increase the number of shares authorized for issuance thereunder by 7,000,000 shares, and in May 2022, our stockholders approved the amendment and restatement of our 2018 Stock Incentive Plan, as amended, or the Amended and Restated 2018 Plan, which increased the number of shares authorized for issuance thereunder by 6,000,000 shares. The Amended and Restated 2018 Plan provides for the granting of stock options, restricted stock and restricted stock units (together, restricted stock awards), stock appreciation rights and other stock-based awards, and has a fungible share pool. Any award that is not a full value award is

counted against the authorized share limits specified as one share for each share of common stock subject to the award, and all full value awards, defined as restricted stock awards or other stock-based awards, are counted as one and a half shares for each one share of common stock subject to such full value award.

As of December 31, 2022, an aggregate of 20,711,629 shares of common stock were reserved for issuance under our stock plans, including outstanding stock options to purchase 8,423,552 shares of common stock, 1,487,394 outstanding restricted stock units, 10,083,911 of common stock available for additional equity awards and 716,772 shares available for future grant under our Amended and Restated 2004 Employee Stock Purchase Plan, as amended, or the Amended and Restated ESPP. Each stock option shall expire within 10 years of issuance. Time-based stock options granted to employees generally vest as to 25% of the shares on the first anniversary of the grant date and 6.25% of the shares at the end of each successive three-month period thereafter until fully vested.

Stock-Based Compensation

The following table summarizes stock-based compensation expenses included in operating costs and expenses:

	Year Ended December 31,		
(In thousands)	**2022**	**2021**	**2020**
Research and development	$ 92,161	$ 68,415	$ 60,464
Selling, general and administrative	138,488	97,302	79,409
Total	$ 230,649	$ 165,717	$ 139,873

The following table summarizes stock-based compensation expense:

	Year Ended December 31,		
(In thousands)	**2022**	**2021**	**2020**
Stock-based compensation expense by type of award:			
Time-based stock options	$ 114,901	$ 118,635	$ 112,971
Time-based restricted stock units	12,791	4,231	6,909
Performance-based restricted stock units	102,925	39,943	11,162
Other equity programs	4,057	6,235	9,402
Less: Stock-based compensation expense capitalized to inventory	(4,025)	(3,327)	(571)
Total	$ 230,649	$ 165,717	$ 139,873

The following table summarizes our unrecognized stock-based compensation expense, net of estimated forfeitures, by type of awards, and the weighted-average period over which that expense is expected to be recognized:

	As of December 31, 2022	
	Unrecognized Expense, Net of Estimated Forfeitures (in thousands)	**Weighted-average Recognition Period (in years)**
Type of award:		
Time-based stock options	$ 187,534	2.47
Time-based restricted stock units	$ 30,676	2.09
Performance-based restricted stock units *	$ 7,695	0.58
Other equity programs	$ 4,225	0.45

* Excludes performance-based restricted stock units for which the associated vesting events are not yet determined to be probable.

Valuation Assumptions for Stock Options

The fair value of stock options, at date of grant, based on the following assumptions, was estimated using the Black-Scholes option-pricing model. Our expected stock-price volatility assumption is based on the historical volatility of our publicly traded stock. The expected life assumption is based on our historical data. The dividend yield assumption is based on the fact

that we have never paid cash dividends and have no present intention to pay cash dividends. The risk-free interest rate used for each grant is equal to the zero coupon rate for instruments with a similar expected life.

The following table summarizes the Black-Scholes valuation assumption inputs for employee stock options granted:

	Year Ended December 31,		
	2022	2021	2020
Risk-free interest rate	1.3 - 4.2%	0.4 - 1.4%	0.3 - 1.7%
Expected dividend yield	—	—	—
Expected option life	5.1 - 7.0 years	5.4 - 6.8 years	5.4 - 7.2 years
Expected volatility	50 - 60%	58 - 63%	61 - 63%

Stock Option Activity

The following table summarizes the activity of our stock option plans, excluding performance-based stock options:

	Number of Options (in thousands)	Weighted-average Exercise Price (per share)	Weighted-average Remaining Contractual Term (in years)	Aggregate Intrinsic Value (in thousands)
Outstanding as of December 31, 2021	8,840	$ 103.87		
Granted	1,874	$ 153.18		
Exercised	(2,490)	$ 84.48		
Cancelled	(356)	$ 129.47		
Outstanding as of December 31, 2022	7,868	$ 120.59	6.53	$ 921,016
Exercisable as of December 31, 2022	4,450	$ 102.17	5.22	$ 602,969
Vested or expected to vest as of December 31, 2022	7,537	$ 119.24	6.44	$ 892,463

The weighted-average fair value of stock options granted was $80.65, $82.59 and $66.28 per share for the years ended December 31, 2022, 2021 and 2020, respectively. The intrinsic value of stock options exercised was $289.3 million, $247.8 million and $177.8 million for the years ended December 31, 2022, 2021 and 2020, respectively. We satisfy stock option exercises with newly issued shares of our common stock.

Performance-Based Stock Options

The following table summarizes the activity of our performance-based stock options granted under our equity plans:

	Number of Options (in thousands)	Weighted-average Exercise Price (per share)	Weighted-average Remaining Contractual Term (in years)	Aggregate Intrinsic Value (in thousands)
Outstanding as of December 31, 2021	1,175	$ 92.31		
Granted	—	$ —		
Exercised	(619)	$ 87.85		
Cancelled	—	$ —		
Outstanding as of December 31, 2022	556	$ 97.28	3.81	$ 77,975
Exercisable as of December 31, 2022	556	$ 97.28	3.81	$ 77,975

During the years ended December 31, 2022, 2021 and 2020, there were 0, 197,102 and 0 performance-based stock options that vested, respectively. The intrinsic value of performance-based stock options exercised was $74.4 million, $40.2 million and $34.1 million for the years ended December 31, 2022, 2021 and 2020, respectively. We satisfy performance-based stock option exercises with newly issued shares of our common stock.

Restricted Stock Units and Awards

The following table summarizes the activity of our restricted stock units and awards granted under our equity plans, excluding performance-based restricted stock units:

	Number of Units (in thousands)	Weighted-average Grant Date Fair Value (per share)
Outstanding as of December 31, 2021	75	$ 158.87
Awarded	249	$ 165.32
Released	(23)	$ 152.98
Cancelled	(9)	$ 143.85
Outstanding as of December 31, 2022	292	$ 165.27

Performance-Based Restricted Stock Units

The following table summarizes the activity of our performance-based restricted stock units granted under our equity plans:

	Number of Units (in thousands)	Weighted-average Grant Date Fair Value (per share)
Outstanding as of December 31, 2021	1,136	$ 143.13
Awarded	690	$ 147.47
Released	(501)	$ 142.72
Cancelled	(130)	$ 143.95
Outstanding as of December 31, 2022	1,195	$ 144.77

The performance-based restricted stock units granted in 2022 and 2021 will vest upon the later of the one-year anniversary of the date of grant and the achievement of specific clinical development, regulatory, commercial and/or financial performance events, as approved by our people, culture and compensation committee.

Employee Stock Purchase Plan

In 2004, we adopted the 2004 Employee Stock Purchase Plan and in 2017, our stockholders approved the Amended and Restated ESPP. In 2020, our stockholders approved an amendment to the Amended and Restated ESPP, to increase the number of shares authorized for issuance to 1,965,789 shares. Under the Amended and Restated ESPP, as amended, each offering period is six months, at the end of which employees may purchase shares of common stock through payroll deductions made over the term of the offering. The per-share purchase price at the end of each offering period is equal to the lesser of 85% of the closing price of our common stock at the beginning or end of the offering period. We issued 119,285 and 124,101 shares during the years ended December 31, 2022 and 2021, respectively.

We estimate the fair value of shares to be issued under the Amended and Restated ESPP, as amended, using the Black-Scholes option-pricing model on the date of grant, or first day of the offering period, using the same methodology approach as the employee stock option grants. The following table summarizes the Black-Scholes valuation assumption inputs for stock purchase rights granted under the employee stock purchase plan:

	Year Ended December 31,		
	2022	2021	2020
Risk-free interest rate	1.4% - 4.5%	0.03% - 0.06%	0.1% - 0.1%
Expected dividend yield	—	—	—
Expected option life	6 months	6 months	6 months
Expected volatility	53% - 71%	41% - 46%	40% - 50%

13. STOCKHOLDERS' (DEFICIT) EQUITY

Preferred Stock

We have authorized up to 5,000,000 shares of preferred stock, $0.01 par value per share, for issuance. The preferred stock will have such rights, preferences, privileges and restrictions, including voting rights, dividend rights, conversion rights, redemption privileges and liquidation preferences, as shall be determined by our board of directors upon its issuance. As of December 31, 2022 and 2021, there were no shares of preferred stock outstanding.

Blackstone Equity Placement

In April 2020, we entered into a stock purchase agreement, or Investors SPA, with certain affiliates of The Blackstone Group Inc., or Investors, pursuant to which we sold 963,486 shares of our common stock to the Investors for aggregate cash consideration of $100.0 million, or $103.79 per share, as part of the broad strategic financing collaboration with The Blackstone Group Inc. The Investors SPA contains customary representations, warranties, and covenants of each of the parties thereto.

14. COMMITMENTS AND CONTINGENCIES

Technology License and Other Commitments

We have licensed from third parties the rights to use certain technologies and information in our research processes as well as in any other products we may develop. In accordance with the related license or technology agreements, we are required to make certain fixed payments to the licensor or a designee of the licensor over various agreement terms. Many of these agreement terms are consistent with the remaining lives of the underlying intellectual property that we have licensed. As of December 31, 2022, our commitments over the next five years to make fixed and cancellable payments under existing license agreements were not material.

Legal Matters

From time to time, we may be a party to litigation, arbitration or other legal proceedings in the course of our business, including the matters described below. The claims and legal proceedings in which we could be involved include challenges to the scope, validity or enforceability of patents relating to our products or product candidates, and challenges by us to the scope, validity or enforceability of the patents held by others. These include claims by third parties that we infringe their patents or breach our license or other agreements with such third parties. The outcome of any such legal proceedings, regardless of the merits, is inherently uncertain. In addition, litigation and related matters are costly and may divert the attention of our management and other resources that would otherwise be engaged in other activities. If we were unable to prevail in any such legal proceedings, our business, results of operations, liquidity and financial condition could be adversely affected. Our accounting policy for accrual of legal costs is to recognize such expenses as incurred.

Government Investigation

We have previously disclosed that, on or about April 9, 2021, we received a subpoena from the U.S. Department of Justice, U.S. Attorney's Office for the District of Massachusetts, requiring production of documents pertaining to our marketing and promotion of ONPATTRO (patisiran) in the U.S. We are cooperating with the U.S. Attorney's Office and producing documents in response to the subpoena. Current and former officers and employees also have received subpoenas in connection with the preservation and production of related materials. Given the ongoing nature of the investigation, it is possible that the U.S. Attorney's Office for the District of Massachusetts or other government entities may request other information from, or issue other subpoenas, findings or similar documents to, us, our related entities and their respective directors, officers and employees. In light of the ongoing nature of the investigation, no determination has been made that a loss, if any, arising from this matter is probable or that the amount of any such loss, or range of loss, is reasonably estimable. We also previously disclosed that since learning of this federal government investigation, our nominating and corporate governance committee is directing our review of and response to the matter.

Patent Infringement Lawsuits

In March 2022, we filed separate lawsuits in the U.S. District Court for the District of Delaware against (1) Pfizer, Inc. and its subsidiary Pharmacia & Upjohn Co. LLC, collectively referred to as Pfizer, and (2) Moderna, Inc., and its subsidiaries ModernaTX, Inc., and Moderna US, Inc., collectively referred to as Moderna. The lawsuits seek damages for infringement of U.S. Patent No. 11,246,933, or '933 Patent, in Pfizer's and Moderna's manufacture and sale of their messenger RNA, or mRNA, COVID-19 vaccines. The patent relates to the Company's biodegradable cationic lipids that are foundational to the success of the mRNA COVID-19 vaccines.

We are seeking judgment that each of Pfizer and Moderna is infringing the '933 Patent, as well as damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the unlicensed uses made of our patented lipids by Pfizer and Moderna, together with interest and costs as may be awarded by the court. As stated in the filed complaints, we are not seeking injunctive relief in these lawsuits.

On May 23, 2022, Moderna filed a partial motion to dismiss, asserting an affirmative defense under Section 1498(a). We responded on May 27, 2022, opposing their motion arguing Moderna had significant non-government sales and the government contract ended in April 2022. Moderna responded on June 13, 2022, requesting a partial motion to dismiss those claims for sales under 1498(a). This motion is fully briefed and pending before the court.

On May 27, 2022, Pfizer filed an answer to our complaint, denying the allegations, and asserting invalidity and non-infringement defenses. In addition, Pfizer added BioNTech SE to the suit and added counter-claims seeking a declaratory judgment that our patent is invalid and a second claim alleging that our patent is invalid due to patent misuse. We believe their defenses and counter-claims have no merit and responded on June 10, 2022, with substantive arguments as to the validity of our claims and the lack of merit of their patent misuse claim.

On July 12, 2022, we filed a new lawsuit against each of Pfizer and Moderna seeking damages for infringing our newly granted U.S. Patent No. 11,382,979 in Pfizer's and Moderna's manufacture and sale of their mRNA COVID-19 vaccines. The parties agreed to combine the two patents in one lawsuit, separately against each of Moderna and Pfizer/BioNTech.

The court has set a trial date of November 12, 2024 for Alnylam v. Moderna and November 18, 2024 for Alnylam v. Pfizer/BioNTech.

Indemnifications

In connection with license agreements we may enter with companies to obtain rights to intellectual property, we may be required to indemnify such companies for certain damages arising in connection with the intellectual property rights licensed under the agreements. Under such agreements, we may be responsible for paying the costs of any litigation relating to the license agreements or the underlying intellectual property rights, including the costs associated with certain litigation regarding the licensed intellectual property. We are also a party to a number of agreements entered into in the ordinary course of business, which contain typical provisions that obligate us to indemnify the other parties to such agreements upon the occurrence of certain events, including litigation or other legal proceedings. In addition, we have agreed to indemnify our officers and directors for expenses, judgments, fines, penalties, excise taxes, and settlement amounts paid in connection with any threatened, pending or completed litigation proceedings, including, for example, the current government investigation, in which an officer or director was, is or will be involved as a party, on account of such person's status as an officer or director, or by reason of any action taken by the officer or director while acting in such capacity, subject to certain limitations. These indemnification costs are charged to selling, general and administrative expense.

Our maximum potential future liability under any such indemnification provisions is uncertain. We have determined that the estimated aggregate fair value of our potential liabilities under all such indemnification provisions is minimal and had not recorded any liability related to such indemnification provisions as of December 31, 2022 or 2021.

15. LEASES

Overview of Significant Leases

We lease three facilities for office and laboratory space in Cambridge, Massachusetts that represent substantially all of our significant lease obligations. An overview of these significant leases are as follows:

675 West Kendall Street

We lease office and laboratory space located at 675 West Kendall Street, Cambridge, Massachusetts for our corporate headquarters from BMR-675 West Kendall Street, LLC, or BMR, under a non-cancelable real property lease. The lease commenced on May 1, 2018 and monthly rent payments became due commencing on February 1, 2019 upon substantial completion of the building improvements, and continue for 15 years, with options to renew for two five-year terms each. Exercise of these options was not determined to be reasonably certain and thus was not included in the operating lease liability on the consolidated balance sheet as of December 31, 2022.

300 Third Street

We lease office and laboratory space located at 300 Third Street, Cambridge, Massachusetts under a non-cancelable real property lease agreement by and between us and ARE-MA Region No. 28, LLC, or ARE-MA, dated as of September 26, 2003, as amended. The term of the lease expires on January 31, 2034 with options to renew for two five-year terms each. Exercise of these options was not determined to be reasonably certain and thus was not included in the operating lease liability on the consolidated balance sheet as of December 31, 2022.

101 Main Street

We lease office space on several floors at 101 Main Street, Cambridge, Massachusetts under non-cancelable real property lease agreements by and between us and RREEF America REIT II CORP. PPP, or RREEF, entered into in March 2015 and May 2015, as amended in September 2020, that will expire in March 2024 and June 2026, respectively, each with an option to

renew for one five-year term. Exercise of these options was not determined to be reasonably certain and thus was not included in the operating lease liability on the consolidated balance sheet as of December 31, 2022.

Other Lease Disclosures

Our facility leases described above generally contain customary provisions allowing the landlords to terminate the leases if we fail to remedy a breach of any of our obligations under any such lease within specified time periods, or upon our bankruptcy or insolvency. The leases do not include any restrictions or covenants that had to be accounted for under the lease guidance.

Total rent expense, including operating expenses, under all of our real property leases was $58.6 million, $59.5 million and $50.7 million for the years ended December 31, 2022, 2021 and 2020, respectively.

The following table summarizes our costs included in operating expenses related to right of use lease assets we have entered into through December 31, 2022:

(In thousands)	Year Ended December 31, 2022	Year Ended December 31, 2021
Operating lease cost	$ 45,789	$ 45,359
Variable lease cost	17,614	18,271
Total	$ 63,403	$ 63,630

Short-term lease costs were not material for the years ended December 31, 2022 and 2021.

Net cash paid for the amounts included in the measurement of the operating lease liability in our consolidated balance sheet and included in change in operating lease liability within operating activities in our consolidated statement of cash flow was $43.1 million and $41.9 million for the years ended December 31, 2022 and 2021, respectively. The weighted-average remaining lease term and weighted-average discount rate for all leases as of December 31, 2022 was 10 years and 8%, respectively, and as of December 31, 2021 was 11 years and 8%, respectively.

Future lease payments for non-cancellable operating leases and a reconciliation to the carrying amount of the operating lease liability presented in the consolidated balance sheet as of December 31, 2022 were as follows, in thousands:

Year Ending December 31	
2023	$ 43,028
2024	46,486
2025	42,867
2026	40,376
2027	38,753
2028 and thereafter	248,622
Total undiscounted lease liability	460,132
Less imputed interest	(156,826)
Total discounted lease liability	$ 303,306
Current operating lease liability	$ 41,967
Non-current operating lease liability	261,339
Total	$ 303,306

16. INCOME TAXES

The domestic and foreign components of loss before income taxes are as follows:

(In thousands)	2022	2021	2020
Domestic	$ (1,148,604)	$ (794,729)	$ (682,859)
Foreign	21,611	(57,415)	(172,741)
Loss before income taxes	$ (1,126,993)	$ (852,144)	$ (855,600)

The provision for income taxes consisted of the following:

	Year Ended December 31,		
(In thousands)	2022	2021	2020
Current provision:			
Domestic	$ —	$ 293	$ 61
Foreign	5,596	3,154	5,837
Total current provision	5,596	3,447	5,898
Deferred benefit:			
Domestic	—	—	393
Foreign	(1,433)	(2,767)	(3,610)
Total deferred benefit	(1,433)	(2,767)	(3,217)
Total provision for income taxes	$ 4,163	$ 680	$ 2,681

During the year ended December 31, 2022, we recorded a net provision for income taxes of $4.2 million. This is primarily comprised of $5.6 million of foreign current provision offset by $1.4 million of foreign deferred provision.

Deferred income taxes reflect the tax effects of temporary differences between the carrying amounts of assets and liabilities for financial reporting and income tax purposes. We establish a valuation allowance when uncertainty exists as to whether all or a portion of the net deferred tax assets will be realized. Components of the net deferred tax asset are as follows:

	As of December 31,	
(In thousands)	2022	2021
Deferred tax assets:		
Net operating loss carryforwards	$ 803,251	$ 745,985
Research and development and other credit carryforwards	381,032	342,431
Sale of future royalties	326,183	302,217
Lease liability	67,242	71,859
Deferred revenue	59,437	76,612
Deferred compensation	52,989	59,349
Intangible assets	264,564	279,082
Capitalized research and development expenditures	206,727	23,039
Other	133,376	48,242
Total deferred tax assets	2,294,801	1,948,816
Deferred tax liabilities:		
Property, plant and equipment, net	(12,786)	(13,170)
Unrealized gain on marketable securities	(5,728)	(16,693)
Right of use assets	(46,819)	(50,562)
Deferred revenue tax accounting method change	(24,995)	(50,380)
Deferred tax asset valuation allowance	(2,193,633)	(1,808,992)
Net deferred tax asset	$ 10,840	$ 9,019

Our effective income tax rate differs from the statutory federal income tax rate, as follows:

	Year Ended December 31,		
(In thousands)	2022	2021	2020
At U.S. federal statutory rate	21.0 %	21.0 %	21.0 %
State taxes, net of federal effect	6.0	5.2	4.5
Stock-based compensation	4.4	4.6	2.2
Tax credits	2.7	4.5	3.3
Other permanent items	(1.5)	(1.0)	(1.5)
Foreign rate differential	(0.5)	(1.7)	(3.5)
Internal reorganization of certain intellectual property rights	—	20.1	12.3
Other	(0.8)	(0.1)	(2.7)
Revaluation of deferred due to rate change	(0.4)	1.1	—
Valuation allowance	(31.3)	(53.8)	(35.9)
Effective income tax rate	(0.4)%	(0.1)%	(0.3)%

We have evaluated the positive and negative evidence bearing upon the realizability of our deferred tax assets. We have concluded, in accordance with the applicable accounting standards, that it is more likely than not that we may not realize the benefit of all of our deferred tax assets, with the exception of the deferred assets related to certain foreign subsidiaries. Accordingly, we have recorded a valuation allowance against the deferred tax assets that management believes will not be realized. We re-evaluate the positive and negative evidence on a quarterly basis. The valuation allowance increased by $384.6 million, $459.3 million and $303.7 million for the years ended December 31, 2022, 2021 and 2020, respectively. The increase in our valuation allowance is primarily due to additional net operating losses for the years ended December 31, 2022 and 2020 and primarily due to the liability related to the sale of future royalties for the year ended December 31, 2021.

On December 22, 2017, the Tax Cuts and Jobs Act, or TCJA, was signed into law. Under the TCJA provisions, effective with tax years beginning on or after January 1, 2022, taxpayers can no longer immediately expense qualified research and development expenditures, including all direct, indirect, overhead and software development costs. Taxpayers are now required to capitalize and amortize these costs over five years for research conducted within the United States or 15 years for research conducted abroad. As a result, the Company capitalized $870.6 million of research and development expenses for the year ended December 31, 2022.

As of December 31, 2022, we had federal and state net operating loss carryforwards, or NOLs, of $2.9 billion and $3.0 billion, respectively, to reduce future taxable income. Federal NOLs of $1.1 billion, generated before 2018, will begin expiring in varying amounts through 2037 unless utilized. The remaining federal NOLs of $1.8 billion, generated after 2017, will be carried forward indefinitely and could be used to offset up to 100% of taxable income of each future tax year for tax years before January 1, 2021 and up to 80% of taxable income in all other future tax years. State NOLs will begin expiring in varying amounts through 2042 unless utilized. As of December 31, 2022, we had federal and state research and development, including Orphan Drug, and state investment tax credit carryforwards of $343.0 million and $62.3 million, respectively, available to reduce future tax liabilities that expire at various dates through 2042. We have a valuation allowance against the net operating loss and tax credit carryforwards as it is unlikely that we will realize these assets. Ownership changes, as defined in the Internal Revenue Code and similar state provisions, including those resulting from the issuance of common stock in connection with our public offerings, may limit the amount of federal and state net operating loss and tax credit carryforwards that can be utilized to offset future taxable income or tax liability. The amount of the limitation is determined in accordance with Section 382 of the Internal Revenue Code and similar state provisions. We have performed an analysis of ownership changes through December 31, 2022. Based on this analysis, we do not believe that any of our federal and state tax attributes will expire unutilized due to Section 382 limitations.

As of December 31, 2022, we had foreign NOLs of $153.3 million to reduce future taxable income which will begin expiring in varying amounts through 2029 unless utilized. We have a valuation allowance against the foreign NOLs as it is unlikely that we will realize these assets.

We apply the accounting guidance in ASC 740 related to accounting for uncertainty in income taxes. Our reserves related to income taxes are based on a determination of whether, and how much of, a tax benefit taken by us in our tax filings or positions is more likely than not to be realized and ultimately sustained upon challenge by a taxing authority based upon its technical merits and subject to certain recognition and measurement criteria. We recognize potential interest and penalties related to unrecognized tax benefits in our provision for income taxes. Our reserve related to income taxes, including potential interest and penalties, was not material as of December 31, 2022 and 2021.

Our uncertain income tax positions do not impact our effective tax rate due to our full valuation allowance in the U.S.

As of December 31, 2022, the unremitted earnings of our foreign subsidiaries are not material. We have not provided for U.S. income taxes or foreign withholding taxes on these earnings as it is our current intention to permanently reinvest these earnings outside the U.S. The tax liability on these earnings is also not material. Events that could trigger a tax liability include, but are not limited to, distributions, reorganizations or restructurings and/or tax law changes.

The tax years 2019 through 2022 remain open to examination by major taxing jurisdictions, which are primarily in the U.S., although net operating loss and tax credit carryforwards generated prior to 2019 may still be adjusted upon examination by the Internal Revenue Service or state tax authorities if they have or will be used in a future period.

17. EMPLOYEE BENEFIT PLANS

We maintain a retirement saving plan under Section 401(k) of the Internal Revenue Code, in which eligible U.S. employees may defer compensation for income tax purposes. Contributions made by employees are limited to the maximum allowable for U.S. federal income tax purposes. The plan allows for a discretionary match in an amount up to 100% of each participant's first 2% of compensation contributed plus 50% of each participant's next 4% of compensation contributed. The expense related to our 401(k) Savings Plan primarily consists of our matching contributions.

Furthermore, we maintain defined benefit plans for employees in certain countries outside the U.S., including retirement benefit plans required by applicable local law. The benefit obligation corresponds to the projected benefit obligations of which the discounted net present value is calculated based on years of employment, expected salary increases and pension adjustments.

For the years ended December 31, 2022, 2021 and 2020 contributions and net periodic benefit costs to such plans generated a total expense of $16.5 million, $13.1 million and $12.0 million, respectively.

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 Chief Executive Officer (principal executive officer) and executive vice president, Chief Financial Officer (principal financial officer), evaluated the effectiveness of our disclosure controls and procedures as of December 31, 2022. The term "disclosure controls and procedures," as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act means controls and other procedures of a company that are designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the SEC's rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is accumulated and communicated to the company's management, including its principal executive and principal financial officers, as appropriate to allow timely decisions regarding required disclosure. Management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Based on the evaluation of our disclosure controls and procedures as of December 31, 2022, our Chief Executive Officer and executive vice president, Chief Financial Officer concluded that, as of such date, our disclosure controls and procedures were effective at the reasonable assurance level.

Management's Annual Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is defined in Rule 13a-15(f) or 15d-15(f) promulgated under the Securities Exchange Act of 1934 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 our assets;
- Provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that our receipts and expenditures are being made only in accordance with authorizations of management and directors; and
- Provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of our 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. 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.

Our management assessed the effectiveness of our internal control over financial reporting as of December 31, 2022. In making this assessment, management used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) in *Internal Control-Integrated Framework* (2013).

Based on our assessment, our management concluded that, as of December 31, 2022, our internal control over financial reporting is effective based on those criteria.

The effectiveness of our internal control over financial reporting as of December 31, 2022 has been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, as stated in their report, which is included herein.

Changes in Internal Control

There were no changes in our internal control over financial reporting during the quarter ended December 31, 2022 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

ITEM 9B. OTHER INFORMATION

None.

ITEM 9C. DISCLOSURE REGARDING FOREIGN JURISDICTIONS THAT PREVENT INSPECTIONS

Not applicable.

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

Incorporated by reference from the information in our Proxy Statement for our 2023 Annual Meeting of Stockholders, which we will file with the SEC within 120 days of the end of the fiscal year to which this Annual Report on Form 10-K relates.

ITEM 11. EXECUTIVE COMPENSATION

Incorporated by reference from the information in our Proxy Statement for our 2023 Annual Meeting of Stockholders, which we will file with the SEC within 120 days of the end of the fiscal year to which this Annual Report on Form 10-K relates.

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

Incorporated by reference from the information in our Proxy Statement for our 2023 Annual Meeting of Stockholders, which we will file with the SEC within 120 days of the end of the fiscal year to which this Annual Report on Form 10-K relates.

Securities Authorized for Issuance Under Equity Compensation Plans

We intend to file with the SEC a definitive Proxy Statement, which we refer to herein as the Proxy Statement, not later than 120 days after the close of the fiscal year ended December 31, 2022. The information required by this item relating to our equity compensation plans is incorporated herein by reference to the information contained under the section captioned “Equity Compensation Plan Information” of the Proxy Statement.

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

Incorporated by reference from the information in our Proxy Statement for our 2023 Annual Meeting of Stockholders, which we will file with the SEC within 120 days of the end of the fiscal year to which this Annual Report on Form 10-K relates.

ITEM 14. PRINCIPAL ACCOUNTANT FEES AND SERVICES

Incorporated by reference from the information in our Proxy Statement for our 2023 Annual Meeting of Stockholders, which we will file with the SEC within 120 days of the end of the fiscal year to which this Annual Report on Form 10-K relates.

PART IV

ITEM 15. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES

(a) (1) Financial Statements

The following consolidated financial statements are filed as part of this report under "Item 8 — Financial Statements and Supplementary Data:"

(a) (2) List of Schedules

All schedules to the consolidated financial statements are omitted as the required information is either inapplicable or presented in the consolidated financial statements.

(a) (3) List of Exhibits

Exhibit No.	Exhibit
2.1*†	Stock Purchase Agreement dated as of January 10, 2014 by and among the Registrant, Sirna Therapeutics, Inc., Merck Sharp & Dohme Corp., and solely for the purposes of certain specified provisions, Merck & Co., Inc. (filed as Exhibit 2.1 to the Registrant's Quarterly Report on Form 10-Q filed on May 9, 2014 (File No. 001-36407) for the quarterly period ended March 31, 2014 and incorporated herein by reference)
3.1	Restated Certificate of Incorporation of the Registrant (filed as Exhibit 3.1C to the Registrant's Current Report on Form 8-K filed on April 26, 2019 (File No. 001-36407) and incorporated herein by reference)
3.2	Second Amended and Restated Bylaws of the Registrant, as amended (filed as Exhibit 3.1 to the Registrant's Quarterly Report on Form 10-Q filed on November 5, 2020 (File No. 001-36407) for the quarterly period ended September 30, 2020 and incorporated herein by reference)
4.1	Specimen certificate evidencing shares of common stock (filed as Exhibit 4.1 to the Registrant's Registration Statement on Form S-1 (File No. 333-113162) and incorporated herein by reference)
4.2	Description of Capital Stock (filed as Exhibit 4.2 to the Registrant's Annual Report on Form 10-K filed on February 13, 2020 (File No. 001-36407) for the year ended December 31, 2019 and incorporated herein by reference)
4.3	Indenture, dated as of September 15, 2022, between the Registrant and The Bank of New York Mellon, as trustee (filed as Exhibit 4.1 to the Registrant's Quarterly Report on Form 10-Q filed on October 27, 2022 (File No. 001-36407) for the quarterly period ended September 30, 2022 and incorporated herein by reference)
4.4	Form of 1.00% Convertible Senior notes due 2027 (filed as Exhibit 4.2 to the Registrant's Current Report on Form 8-K filed on September 16, 2022 (File No. 001-36407) and incorporated herein by reference)
10.1**	Amended and Restated 2004 Stock Incentive Plan (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on August 8, 2014 (File No. 001-36407) for the quarterly period ended June 30, 2014 and incorporated herein by reference)
10.2**	Forms of Incentive Stock Option Agreement and Nonstatutory Stock Option Agreement under 2004 Stock Incentive Plan, as amended (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on August 8, 2014 (File No. 001-36407) for the quarterly period ended June 30, 2014 and incorporated herein by reference)
10.3**	Second Amended and Restated 2009 Stock Incentive Plan (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on August 9, 2017 (File No. 001-36407) for the quarterly period ended June 30, 2017 and incorporated herein by reference)

Exhibit No.	Exhibit
10.4**	Forms of Incentive Stock Option Agreement, Nonstatutory Stock Option Agreements, Restricted Stock Agreement and Restricted Stock Unit Award Agreement under Second Amended and Restated 2009 Stock Incentive Plan (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on August 9, 2017 (File No. 001-36407) for the quarterly period ended June 30, 2017 and incorporated herein by reference)
10.5**	Form of Nonstatutory Stock Option Agreement for Non-Plan Inducement Grant (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on November 3, 2016 (File No. 001-36407) for the quarterly period ended September 30, 2016 and incorporated herein by reference)
10.6**	Amended and Restated 2004 Employee Stock Purchase Plan (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on May 2, 2019 (File No. 001-36407) for the quarterly period ended March 31, 2019 and incorporated herein by reference)
10.7**	Amendment to Amended and Restated 2004 Employee Stock Purchase Plan, as amended (filed as Exhibit 10.6 to the Registrant's Quarterly Report on Form 10-Q filed on August 6, 2020 (File No. 001-36407) for the quarterly period ended June 30, 2020 and incorporated herein by reference)
10.8**	Amended and Restated 2018 Stock Incentive Plan (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on July 28, 2022 (File No. 001-36407) for the quarterly period ended June 30, 2022 and incorporated herein by reference)
10.9**	Forms of Incentive Stock Option Agreement, Nonstatutory Stock Option Agreements, Restricted Stock Agreement and Restricted Stock Unit Award Agreement under 2018 Stock Incentive Plan, as amended (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on August 2, 2018 (File No. 001-36407) for the quarterly period ended June 30, 2018 and incorporated herein by reference)
10.10	Forms of Nonstatutory Stock Option Agreements under 2018 Stock Incentive Plan, as amended (filed as Exhibit 10.11 to the Registrant's Annual Report on Form 10-K filed on February 10, 2022 (File No. 001-36407) for the year ended December 31, 2021 and incorporated herein by reference)
10.11**	Forms of Stock Unit Award Agreements under 2018 Stock Incentive Plan, as amended (filed as Exhibit 10.12 to the Registrant's Annual Report on Form 10-K filed on February 10, 2022 (File No. 001-36407) for the year ended December 31, 2021 and incorporated herein by reference)
10.12**	Amended and Restated Annual Incentive Program, as amended (filed as Exhibit 10.12 to the Registrant's Annual Report on Form 10-K filed on February 11, 2021 (File No. 001-36407) for the year ended December 31, 2020 and incorporated herein by reference)
10.13**	Employment Agreement between the Registrant and Dr. Yvonne L. Greenstreet dated December 14, 2021 (filed as Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed on December 20, 2021 (File No. 001-36407) and incorporated herein by reference)
10.14**	Letter Agreement between the Registrant and John M. Maraganore, Ph.D. dated October 26, 2021 (filed as Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed on October 28, 2021 (File No. 001-36407) and incorporated herein by reference)
10.15**	Letter Agreement between the Registrant and Indrani L. Franchini dated January 14, 2022 (filed as Exhibit 10.1 to Registrant's Quarterly Report on Form 10-Q filed on April 28, 2022 (File No. 001-36407) for the quarterly period ended March 31, 2022 and incorporated herein by reference)
10.16**	Letter Agreement between the Registrant and Laurie B. Keating dated September 6, 2021 (filed as Exhibit 10.1 to Registrant's Quarterly Report on Form 10-Q filed on October 28, 2021 (File No. 001-36407) for the quarterly period ended September 30, 2021 and incorporated herein by reference)
10.17**	Consulting Agreement dated as of March 1, 2006 by and between the Registrant and Phillip A. Sharp, Ph.D., as amended (filed as Exhibit 10.16 to the Registrant's Annual Report on Form 10-K filed on February 19, 2013 (File No. 000-50743) for the year ended December 31, 2012 and incorporated herein by reference)
10.18**	Consulting Agreement dated as of April 20, 2012 by and between the Registrant and Dennis A. Ausiello, M.D. (filed as Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed on April 23, 2012 (File No. 000-50743) and incorporated herein by reference)
10.19**	Forms of Director and Officer Indemnification Agreements (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on August 4, 2016 (File No. 001-36407) for the quarterly period ended June 30, 2016 and incorporated herein by reference)

Exhibit No.	Exhibit
10.20**	Form of Change in Control Agreement (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on November 7, 2017 (File No. 001-36407) for the quarterly period ended September 30, 2017 and incorporated herein by reference)
10.21	Lease, dated as of September 26, 2003 by and between the Registrant and Three Hundred Third Street LLC (filed as Exhibit 10.15 to the Registrant's Registration Statement on Form S-1 (File No. 333-113162) and incorporated herein by reference)
10.22	First Amendment to Lease, dated March 16, 2006, by and between the Registrant and ARE-MA Region No. 28, LLC (filed as Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed on March 17, 2006 (File No. 000-50743) and incorporated herein by reference)
10.23	Second Amendment to Lease, dated June 26, 2009, by and between the Registrant and ARE-MA Region No. 28, LLC (filed as Exhibit 10.4 to the Registrant's Quarterly Report on Form 10-Q filed on August 7, 2009 (File No. 000-50743) for the quarterly period ended June 30, 2009 and incorporated herein by reference)
10.24	Third Amendment to Lease, dated May 11, 2010, by and between the Registrant and ARE-MA Region No. 28, LLC (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on August 5, 2010 (File No. 000-50743) for the quarterly period ended June 30, 2010 and incorporated herein by reference)
10.25	Fourth Amendment to Lease, dated November 4, 2011, by and between the Registrant and ARE-MA Region No. 28, LLC (filed as Exhibit 10.19 to the Registrant's Annual Report on Form 10-K filed on February 13, 2012 (File No. 000-50743) for the year ended December 31, 2011 and incorporated herein by reference)
10.26	Fifth Amendment to Lease, dated March 27, 2014, by and between the Registrant and ARE-MA Region No. 28, LLC (filed as Exhibit 10.5 to the Registrant's Amendment No. 1 to its Quarterly Report on Form 10-Q/A filed on January 9, 2015 (File No. 001-36407) for the quarterly period ended March 31, 2014 and incorporated herein by reference)
10.27	Sixth Amendment to Lease, dated August 14, 2018, by and between the Registrant and ARE-MA Region No. 28, LLC. (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on November 7, 2018 (File No. 001-36407) for the quarterly period ended September 30, 2018 and incorporated herein by reference)
10.28†	Lease entered into as of February 10, 2012 by and between BMR-Fresh Pond Research Park LLC and the Registrant (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on May 3, 2012 (File No. 000-50743) for the quarterly period ended March 31, 2012 and incorporated herein by reference)
10.29	First Amendment to Lease entered into as of August 2, 2016 by and between BMR-Fresh Pond Research Park LLC and the Registrant (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on November 3, 2016 (File No. 001-36407) for the quarterly period ended September 30, 2016 and incorporated herein by reference)
10.30	Second Amendment to Lease entered into as of April 28, 2021 by and between BMR-Fresh Pond Research Park LLC and the Registrant (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on August 3, 2021 (File No. 001-36407) for the quarterly period ended June 30, 2021 and incorporated herein by reference)
10.31	Lease dated as of March 18, 2015 between RREEF America REIT II CORP. PPP and the Registrant, as amended by First Amendment to Lease dated as of April 16, 2015 (filed as Exhibit 10.5 to the Registrant's Quarterly Report on Form 10-Q filed on August 7, 2015 (File No. 001-36407) for the quarterly period ended June 30, 2015 and incorporated herein by reference)
10.32	Second Amendment to Lease, dated September 27, 2018, by and between Registrant and RREEF America REIT II CORP. PPP. (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on November 7, 2018 (File No. 001-36407) for the quarterly period ended September 30, 2018 and incorporated herein by reference)
10.33	Lease dated as of May 5, 2015 between RREEF America REIT II CORP. PPP and the Registrant (filed as Exhibit 10.6 to the Registrant's Quarterly Report on Form 10-Q filed on August 7, 2015 (File No. 001-36407) for the quarterly period ended June 30, 2015 and incorporated herein by reference)
10.34	First Amendment to Lease entered into between the Registrant and RREEF America REIT II CORP. PPP dated September 30, 2020. (filed as Exhibit 10.3 to the Registrant's Quarterly Report on Form 10-Q filed on November 5, 2020 (File No. 001-36407) for the quarterly period ended September 30, 2020 and incorporated herein by reference)

Exhibit No.	Exhibit
10.35	Lease entered into as of April 3, 2015 by and between BMR-675 West Kendall Street LLC and the Registrant (filed as Exhibit 10.7 to the Registrant's Quarterly Report on Form 10-Q filed on August 7, 2015 (File No. 001-36407) for the quarterly period ended June 30, 2015 and incorporated herein by reference)
10.36	Purchase and Sale Agreement entered into as of February 10, 2016 by and between 20 Commerce LLC and the Registrant (filed as Exhibit 10.3 to the Registrant's Quarterly Report on Form 10-Q filed on May 4, 2016 (File No. 001-36407) for the quarterly period ended March 31, 2016 and incorporated herein by reference)
10.37†	Sublicense Agreement dated effective January 8, 2007 among the Registrant and INEX Pharmaceuticals Corporation (now Arbutus Biopharma Corporation, as successor in interest) (filed as Exhibit 10.38 to the Registrant's Annual Report on Form 10-K filed on February 18, 2011 (File No. 000-50743) for the year ended December 31, 2010 and incorporated herein by reference)
10.38†	Sponsored Research Agreement dated as of July 27, 2009 by and among the Registrant, The University of British Columbia and Acuitas Therapeutics Inc. (formerly AlCana Technologies, Inc.) (filed as Exhibit 10.1 to the Registrant's Current Report on Form 8-K filed on June 29, 2011 (File No. 000-50743) and incorporated herein by reference)
10.39†	Supplemental Agreement effective July 27, 2009 by and among the Registrant, Arbutus Biopharma Corporation (formerly Tekmira Pharmaceuticals Corporation), Protiva Biotherapeutics Inc., The University of British Columbia and Acuitas Therapeutics Inc. (formerly AlCana Technologies, Inc.) (filed as Exhibit 10.2 to the Registrant's Current Report on Form 8-K filed on June 29, 2011 (File No. 000-50743) and incorporated herein by reference)
10.40†	Amendment No. 1, dated as of July 27, 2011, to the Sponsored Research Agreement dated as of July 27, 2009 by and among the Registrant, The University of British Columbia and Acuitas Therapeutics Inc. (formerly AlCana Technologies, Inc.) (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on November 3, 2011 (File No. 000-50743) for the quarterly period ended September 30, 2011 and incorporated herein by reference)
10.41†#	Cross-License Agreement dated as of November 12, 2012 by and among the Registrant, Arbutus Biopharma Corporation (formerly Tekmira Pharmaceuticals Corporation) and Protiva Biotherapeutics Inc.
10.42†	Settlement Agreement and General Release entered into as of November 12, 2012 by and among Arbutus Biopharma Corporation (formerly Tekmira Pharmaceuticals Corporation), Protiva Biotherapeutics Inc., the Registrant and Acuitas Therapeutics Inc. (formerly AlCana Technologies, Inc.) (filed as Exhibit 10.51 to the Registrant's Annual Report on Form 10-K filed on February 19, 2013 (File No. 000-50743) for the year ended December 31, 2012 and incorporated herein by reference)
10.43	Stock Purchase Agreement dated as of April 8, 2019 by and between the Registrant and Regeneron Pharmaceuticals, Inc. (filed as Exhibit 10.6 to the Registrant's Quarterly Report on Form 10-Q filed on August 6, 2019 (File No. 001-36407) for the quarterly period ended June 30, 2019 and incorporated herein by reference)
10.44†	Investor Agreement dated as of April 8, 2019 by and between the Registrant and Regeneron Pharmaceuticals, Inc. (filed as Exhibit 10.7 to the Registrant's Quarterly Report on Form 10-Q filed on August 6, 2019 (File No. 001-36407) for the quarterly period ended June 30, 2019 and incorporated herein by reference)
10.45†	Master Agreement dated as of April 8, 2019 by and between the Registrant and Regeneron Pharmaceuticals, Inc., including the Form of Co-Co Collaboration Agreement and Form of License Agreement included as exhibits thereto (filed as Exhibit 10.8 to the Registrant's Quarterly Report on Form 10-Q filed on August 6, 2019 (File No. 001-36407) for the quarterly period ended June 30, 2019 and incorporated herein by reference)
10.46†#	License and Collaboration Agreement dated as of February 3, 2013 by and among The Medicines Company and the Registrant
10.47	Amendment to License and Collaboration Agreement, dated as of November 22, 2019 between the Registrant and The Medicines Company (filed as Exhibit 10.50 to the Registrant's Annual Report on Form 10-K filed on February 13, 2020 (File No. 001-36407) for the year ended December 31, 2019 and incorporated herein by reference)
10.48†#	Amendment No. 2 to License and Collaboration Agreement, dated as of October 31, 2022 between the Registrant and The Medicines Company
10.49†	Master Collaboration Agreement dated as of January 11, 2014 by and between the Registrant and Sanofi Genzyme (formerly Genzyme Corporation) (filed as Exhibit 10.4 to the Registrant's Quarterly Report on Form 10-Q filed on May 9, 2014 (File No. 001-36407) for the quarterly period ended March 31, 2014 and incorporated herein by reference)

Exhibit No.	Exhibit
10.50†	Amendment No. 1 effective as of July 1, 2015 to Master Collaboration Agreement dated as of January 11, 2014 by and between the Registrant and Sanofi Genzyme (formerly Genzyme Corporation) (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on November 9, 2015 (File No. 001-36407) for the quarterly period ended September 30, 2015 and incorporated herein by reference)
10.51†	Amendment No. 2 entered into as of January 6, 2018 to the Master Collaboration Agreement dated as of January 11, 2014, as amended by Amendment No. 1, by and between the Registrant and Genzyme Corporation (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on May 4, 2018 (File No. 001-36407) for the quarterly period ended March 31, 2018 and incorporated herein by reference)
10.52†	Amendment No. 3 entered into as of April 8, 2019 to the Master Collaboration Agreement dated as of January 11, 2014, as amended by Amendment No. 1 and Amendment No. 2 by and between the Registrant and Genzyme Corporation (filed as Exhibit 10.3 to the Registrant's Quarterly Report on Form 10-Q filed on August 6, 2019 (File No. 001-36407) for the quarterly period ended June 30, 2019 and incorporated herein by reference)
10.53†	Exclusive License Agreement entered into as of January 6, 2018 by and between the Registrant and Genzyme Corporation (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on May 4, 2018 (File No. 001-36407) for the quarterly period ended March 31, 2018 and incorporated herein by reference)
10.54†	Amended and Restated ALN-AT3 Global License Terms entered into as of April 8, 2019 by and between the Registrant and Genzyme Corporation (filed as Exhibit 10.4 to the Registrant's Quarterly Report on Form 10-Q filed on August 6, 2019 (File No. 001-36407) for the quarterly period ended June 30, 2019 and incorporated herein by reference)
10.55†	Second Amended and Restated Strategic Collaboration and License Agreement dated January 8, 2015 between Ionis Pharmaceuticals, Inc. (formerly Isis Pharmaceuticals, Inc.) and the Registrant (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on May 8, 2015 (File No. 001-36407) for the quarterly period ended March 31, 2015 and incorporated herein by reference)
10.56†	Amendment No. 1 dated as of July 13, 2015 to Second Amended and Restated Strategic Collaboration and License Agreement dated as of January 8, 2015 by and among the Registrant and Ionis Pharmaceuticals, Inc. (formerly Isis Pharmaceuticals, Inc.) (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on November 9, 2015 (File No. 001-36407) for the quarterly period ended September 30, 2015 and incorporated herein by reference)
10.57†	Amended and Restated Development and Manufacturing Services Agreement effective as of July 6, 2015 by and between the Registrant and Agilent Technologies, Inc. (filed as Exhibit 10.3 to the Registrant's Quarterly Report on Form 10-Q filed on November 9, 2015 (File No. 001-36407) for the quarterly period ended September 30, 2015 and incorporated herein by reference)
10.58†	Manufacturing Services Agreement effective as of March 28, 2018 by and between the Registrant and Agilent Technologies, Inc. (filed as Exhibit 10.4 to the Registrant's Quarterly Report on Form 10-Q filed on May 4, 2018 (File No. 001-36407) for the quarterly period ended March 31, 2018 and incorporated herein by reference)
10.59†	Purchase and Sale Agreement dated April 10, 2020 between BX Bodyguard Royalties L.P. and the Registrant (filed as Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q filed on August 6, 2020 (File No. 001-36407) for the quarterly period ended June 30, 2020 and incorporated herein by reference)
10.60*#	Amendment to Purchase and Sale Agreement dated October 31, 2022 between BX Bodyguard Royalties L.P. and the Registrant
10.61	Stock Purchase Agreement by and among the Registrant, as Borrower, and the investors listed in Exhibit A thereto, dated April 10, 2020 (filed as Exhibit 4.2 to the Registrant's Registration Statement on Form S-3 filed on June 5, 2020 (File No. 333-238989) and incorporated herein by reference)
10.62*†	Co-Development Agreement between the Registrant and BXLS V Bodyguard – PCP L.P. and BXLS Family Investment Partnership V – ESC L.P. dated August 15, 2020 (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on November 5, 2020 (File No. 001-36407) for the quarterly period ended September 30, 2020 and incorporated herein by reference)
10.63*†	Amendment No. 1 to Co-Development Agreement between the Registrant and BXLS V Bodyguard – PCP L.P. and BXLS Family Investment Partnership V – ESC L.P. dated November 23, 2021 (filed as Exhibit 10.70 to the Registrant's Annual Report on Form 10-K filed on February 10, 2022 (File No. 001-36407) for the year ended December 31, 2021 and incorporated herein by reference)

Exhibit No.	Exhibit
10.64†	Patent Cross-License Agreement dated April 3, 2020 between Dicerna Pharmaceuticals, Inc. and the Registrant (filed as Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q filed on August 6, 2020 (File No. 001-36407) for the quarterly period ended June 30, 2020 and incorporated herein by reference)
10.65	Form of Capped Call Transaction Confirmation (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K, File No. 001-36407, filed on September 16, 2022)
21.1#	Subsidiaries of the Registrant
23.1#	Consent of PricewaterhouseCoopers LLP, an Independent Registered Public Accounting Firm
31.1#	Certification pursuant to Section 302 of the Sarbanes-Oxley Act of 2002, Rule 13(a)- 14(a)/15d-14(a), by Principal Executive Officer
31.2#	Certification pursuant to Section 302 of the Sarbanes-Oxley Act of 2002, Rule 13(a)- 14(a)/15d-14(a), by Principal Financial Officer
32.1#	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, by Principal Executive Officer
32.2#	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, by Principal Financial Officer
101.SCH#	Inline XBRL Taxonomy Extension Schema Document
101.CAL#	Inline XBRL Taxonomy Extension Calculation Linkbase Document
101.LAB#	Inline XBRL Taxonomy Extension Label Linkbase Document
101.PRE#	Inline XBRL Taxonomy Extension Presentation Linkbase Document
101.DEF#	Inline XBRL Taxonomy Extension Definition Linkbase Document
104	Cover Page Interactive Data File (formatted as inline XBRL with applicable taxonomy extension information contained in Exhibits 101.)
*	Schedules, exhibits and similar supporting attachments or agreements to this exhibit are omitted pursuant to Item 601(b)(2) of Regulation S-K. The Registrant agrees to furnish a supplemental copy of any omitted schedule or similar attachment to the Securities and Exchange Commission upon request.
**	Management contracts or compensatory plans or arrangements required to be filed as an exhibit hereto pursuant to Item 15(a) of Form 10-K.
†	Portions of this exhibit (indicated by asterisks) have been omitted in accordance with the rules of the Securities and Exchange Commission because such information (i) is not material and (ii) would likely cause competitive harm to the Registrant if publicly disclosed.
#	Filed herewith.

ITEM 16. FORM 10-K SUMMARY

None.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this Report to be signed on its behalf by the undersigned, thereunto duly authorized, on February 23, 2023.

ALNYLAM PHARMACEUTICALS, INC.

By: /s/ Yvonne L. Greenstreet, MBChB
Yvonne L. Greenstreet, MBChB
Chief Executive Officer

Pursuant to the requirements of the Securities Exchange Act of 1934, the Report has been signed below by the following persons on behalf of the Registrant and in the capacities indicated as of February 23, 2023.

Name	Title
/s/ Yvonne L. Greenstreet, MBChB Yvonne L. Greenstreet, MBChB	Director and Chief Executive Officer (Principal Executive Officer)
/s/ Jeffrey V. Poulton Jeffrey V. Poulton	Executive Vice President, Chief Financial Officer (Principal Financial and Accounting Officer)
/s/ Dennis A. Ausiello, M.D. Dennis A. Ausiello, M.D.	Director
/s/ Carolyn R. Bertozzi, Ph.D. Carolyn R. Bertozzi, Ph.D.	Director
/s/ Michael W. Bonney Michael W. Bonney	Director
/s/ Olivier Brandicourt, M.D. Olivier Brandicourt, M.D.	Director
/s/ Marsha H. Fanucci Marsha H. Fanucci	Director
/s/ Margaret A. Hamburg, M.D. Margaret A. Hamburg, M.D.	Director
/s/ David E.I. Pyott David E.I. Pyott	Director
/s/ Colleen F. Reitan Colleen F. Reitan	Director
/s/ Amy W. Schulman Amy W. Schulman	Director
/s/ Phillip A. Sharp, Ph.D. Phillip A. Sharp, Ph.D.	Director
/s/ Elliott Sigal, M.D., Ph.D. Elliott Sigal, M.D., Ph.D.	Director

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Double asterisks denote omissions.

CROSS-LICENSE AGREEMENT

By and Among

ALNYLAM PHARMACEUTICALS, INC.

TEKMIRA PHARMACEUTICALS CORPORATION

And

PROTIVA BIOTHERAPEUTICS INC.

Dated: November 12, 2012

TABLE OF CONTENTS

CROSS-LICENSE AGREEMENT

This Cross-License Agreement (this "Agreement") is entered into as of November 12, 2012 (the "Effective Date"), by and among ALNYLAM PHARMACEUTICALS, INC., a corporation organized under the laws of the State of Delaware having a principal office at 300 Third Street, Cambridge, MA 02142, U.S.A. ("Alnylam"), TEKMIRA PHARMACEUTICALS CORPORATION, a Canadian corporation having a principal office at 100-8900 Glenlyon Parkway, Burnaby, B.C., Canada V5J 5J8 ("Tekmira"), and, solely with respect to Section 10.12, PROTIVA BIOTHERAPEUTICS INC., a wholly-owned subsidiary of Tekmira and a British Columbia corporation with a principal place of business at 100-8900 Glenlyon Parkway, Burnaby, B.C., Canada V5J 5J8 ("Protiva").

RECITALS

WHEREAS, Tekmira owns or controls certain intellectual property covering certain nucleic acid delivery technology known as Lipid Nanoparticle or SNALP ("LNP") technology (the "LNP/SNALP Technology") that is useful for the delivery of a variety of therapeutic products, including those that function through RNA interference ("RNAi") or the modulation of microRNAs ("miRNAs"), and is also engaged in the business of discovering, developing, manufacturing and commercializing human therapeutic products;

WHEREAS, Alnylam owns or controls certain intellectual property covering fundamental aspects of the structure and uses of therapeutic products that function through RNAi or the modulation of miRNA and certain intellectual property covering LNP/SNALP Technology; and Alnylam is developing capabilities to develop and commercialize such therapeutic products;

WHEREAS, Alnylam and Tekmira are parties to several existing agreements relating to RNAi, miRNA and SNALP/LNP Technology, including an Amended and Restated License and Collaboration Agreement dated May 30, 2008 (the "Alnylam-Tekmira LCA"); an Amended and Restated Cross-License Agreement dated May 30, 2008, between Alnylam and Protiva, now a wholly owned subsidiary of Tekmira (as amended, the "Alnylam-Protiva CLA" and collectively with the Alnylam-Tekmira LCA, the "Prior Cross-License Agreements"); a Development, Manufacturing and Supply Agreement dated January 2, 2009, as amended, and a Quality Assurance Agreement dated January 29, 2009 (collectively, the "Manufacturing Agreements"); a Supplemental Agreement dated July 27, 2009, among Tekmira, Protiva, Alnylam, AlCana Technologies, Inc. ("AlCana") and the University of British Columbia ("UBC") (the "Supplemental Agreement") and a related Sponsored Research Agreement dated July 26, 2009, among Alnylam, UBC and AlCana (the "Sponsored Research Agreement"); and a Sublicense Agreement dated January 8, 2007, between Alnylam and Inex Pharmaceuticals Corporation (to which Tekmira is the successor in interest) (the "UBC Sublicense");

WHEREAS, the Parties have entered into a Settlement Agreement concurrently with the execution of this Agreement (the "Settlement Agreement") pursuant to which they have agreed to settle certain disputes between them;

WHEREAS, in connection with the Settlement Agreement, the Parties have agreed to replace the Prior Cross-License Agreements with this Agreement, supersede rights and obligations under the Supplemental Agreement as between themselves with the rights and obligations set forth in this Agreement, and terminate the Manufacturing Agreements; and

NOW, THEREFORE, in consideration of the mutual covenants contained herein, and other good and valuable consideration, the receipt of which is hereby acknowledged, Alnylam and Tekmira enter into this Agreement effective as of the Effective Date:

ARTICLE I- DEFINITIONS

General. When used in this Agreement, each of the following terms, whether used in the singular or plural, will have the meanings set forth in this Article I.

1.1 Act means the United States Federal Food, Drug, and Cosmetic Act of 1938, 21 U.S.C. §§321 et seq., as such may be amended from time to time, and its implementing regulations.

1.2 Active Internal Development Program means, with respect to a particular siRNA Product or miRNA Product, that, as of the time of Target selection under Section 3.3(a), there is an active program of Research, Development or Commercialization with respect to such siRNA Product or miRNA Product at such Party or any of its Affiliates.

1.3 Affiliate means, with respect to a Person, any corporation, company, partnership, joint venture and/or firm which controls, is controlled by, or is under common control with such Person. For purposes of the foregoing sentence, "control" means (a) in the case of corporate entities, direct or indirect ownership of at least fifty percent (50%) of the stock or shares having the right to vote for the election of directors, or (b) in the case of non-corporate entities, direct or indirect ownership of at least fifty percent (50%) of the equity interest with the power to direct the management and policies of such non-corporate entities.

1.4 Aggregate Annual Net Sales means, for each calendar year starting with the calendar year in which the First Commercial Sale occurs for a Product, the total Net Sales of such Product during such calendar year.

1.5 ALN-TTR means Alnylam's siRNA Product in an LNP Formulation that is designed to target the human TTR gene product.

1.6 ALN-VSP means Alnylam's siRNA Product in an LNP Formulation that is designed to target the human VEGF and KSP gene products.

1.7 Alnylam Exclusive Target means any of the Alnylam Existing Exclusive Targets or any of the Alnylam Additional Exclusive Targets.

1.8 Alnylam Existing Exclusive Target means any of the following Targets: VSP (VEGF and KSP used in combination), TTR and PCSK9.

1.9 Alnylam Existing In-License means any of the agreements set forth on Schedule 1.9, pursuant to which Alnylam has a license from any Third Party under any Alnylam Licensed Technology.

1.10 Alnylam Existing Sublicense means any of the agreements set forth on Schedule 1.10, pursuant to which Alnylam has granted a sublicense to any Third Party under any Tekmira Combined Licensed Technology and/or Category 1 Patent.

1.11 Alnylam Field means the use of siRNA Products or miRNA Products directed to an Alnylam Target for the prevention, treatment or palliation of human disease, and related Research, Development and Commercialization activities.

1.12 Alnylam Know-How means all Know-How Controlled by Alnylam as of the Effective Date and that, prior to the Effective Date, was (a) disclosed by Alnylam to Tekmira or (b) otherwise learned by Tekmira; provided, that Alnylam Know-How shall not include Know-How learned by Tekmira solely as a result of the litigation settled pursuant to the Settlement Agreement.

1.13 Alnylam Licensed Technology means, collectively, the Alnylam Patents and the Alnylam Know-How.

1.14 Alnylam Non-Exclusive Target means any Target that is not an Alnylam Exclusive Target or a Tekmira Exclusive Target.

1.15 Alnylam Patent means any Patent Controlled by Alnylam as of the Effective Date that was filed, or claims priority to a Patent that was filed, before April 15, 2010, or any foreign counterpart of any of the foregoing Patents, and that either:

(a) is listed on Schedule 1.15; or

(b) is related to general siRNA structures or modifications (excluding conjugated siRNAs); or

(c) has claims relating to a lipid or an LNP Formulation or its manufacture; or

(d) has claims relating to non-conjugated siRNAs directed to a Tekmira Target.

Alnylam Patents shall not include any Patent that (i) is a UBC Patent; or (ii) is Controlled by Alnylam pursuant to an in-license that is not an Alnylam Existing In-License.

Notwithstanding the foregoing, the licenses granted to Tekmira under Section 2.1 with respect to the Patents in Section 1.15(c) above will only include Researching, Developing and Commercializing Tekmira Products in an LNP Formulation.

1.16 Alnylam Product means an siRNA Product or miRNA Product Researched, Developed or Commercialized by Alnylam, its Affiliates or Sublicensees that is directed to an Alnylam Target.

1.17 Alnylam Sublicensable Product means an Alnylam Product that has been developed by Alnylam or its Affiliates [**]. Any such Alnylam Product described in clause (a) may also include existing or future back up or improvement oligonucleotide products directed to the same Target as such Product in LNP Formulations or other lipid-based formulations.

1.18 Alnylam Target means any of the Alnylam Exclusive Targets or Alnylam Non-Exclusive Targets.

1.19 Biodefense Target means (a) a Target within the genome of one or more Category A, B and C pathogens, as defined by the National Institute of Allergy and Infectious Diseases, including without limitation, pathogens set forth on Schedule 1.19, but specifically excluding influenza virus, or (b) an endogenous cellular Target against which Alnylam Develops and/or Commercializes an Alnylam Product for commercial supply to one or more Funding Authorities.

1.20 Bona Fide Collaboration means a collaboration between Alnylam and one or more Third Parties involving Research, Development, Manufacture and/or Commercialization of one or more Alnylam Products and established under a written agreement in which (a) the scope of the licenses granted, and financial or other commitments of value, are of material value to Alnylam, and (b) Alnylam undertakes and performs substantial, mutual research, development and/or commercialization activity with the Third Party. For purposes of clarity, it is understood and agreed that no collaboration in which all or substantially all of Alnylam's contributions or anticipated contributions are or will be in the form of the grant by Alnylam of licenses or sublicenses to one or more intellectual property rights will be considered a Bona Fide Collaboration.

1.21 Business Day means a day on which banking institutions in Boston, Massachusetts and Vancouver, British Columbia, Canada, are open for business.

1.22 Category 1 Patent means any Patent set forth on Schedule 1.22, any Patent Controlled by Tekmira after the Effective Date that claims priority to any of the Patents set forth on Schedule 1.22, or any foreign counterpart of any of the foregoing Patents.

1.23 Category 2 Patent means any Patent set forth on Schedule 1.23, any Patent Controlled by Alnylam after the Effective Date that claims priority to any of the Patents set forth on Schedule 1.23, or any foreign counterpart of any of the foregoing Patents.

1.24 Category 3 Patent means any Patent set forth on Schedule 1.24, any Patent Controlled by Alnylam after the Effective Date that claims priority to any of the Patents set forth on Schedule 1.24, or any foreign counterpart of any of the foregoing Patents.

1.25 Combination Product means a product that incorporates in a combination one or more pharmacologically active ingredients in addition to the active pharmaceutical ingredient in the Alnylam Product or Tekmira Product, as applicable.

1.26 Commercialize or Commercialization means any and all activities directed to Manufacturing (including, without limitation, by means of contract manufacturers), marketing,

promoting, distributing, importing, exporting and selling a Product, in each case for commercial purposes, and activities directed to obtaining pricing and reimbursement approvals, as applicable.

1.27 Confidential Information means all proprietary or confidential information and materials, patentable or otherwise, of a Party disclosed by or on behalf of such Party to the other Party before, on or after the Effective Date, including, without limitation, chemical substances, formulations, techniques, methodology, equipment, data, reports, Know-How, sources of supply, patent positioning, business plans, and also including without limitation proprietary and confidential information of Third Parties in possession of such Party under an obligation of confidentiality, whether or not related to making, using or selling Products.

1.28 Control, Controls or Controlled by means, with respect to any Know-How or Patent, the possession of (whether by ownership or license, other than pursuant to this Agreement), or the ability of a Party or any of its Existing Affiliates to grant access to, or a license or sublicense of, such Know-How or Patent as provided for herein without violating the terms of any agreement or other arrangement with any Third Party existing at the time such Party would be required hereunder to grant the other Party such access or license or sublicense.

1.29 Cover, Covers or Covered by means, with respect to a product and a Patent, that, but for ownership of or a license or sublicense under such Patent, the making, using, selling, offering for sale or importing of, or other stated action with respect to, such product would infringe such Patent (or, if such Patent is a patent application, would infringe a patent issued from such patent application).

1.30 Develop, Developing or Development means with respect to a Product, preclinical and clinical drug development activities, including without limitation: test method development and stability testing, toxicology, formulations, manufacturing scale-up, preclinical and clinical Manufacture, quality assurance/quality control development, statistical analysis and report writing; clinical studies and regulatory affairs; Regulatory Approval and registration.

1.31 Existing Affiliate means, with respect to a Party, an Affiliate of such Party as of the Effective Date.

1.32 FDA means the United States Food and Drug Administration or any successor agency thereto.

1.33 First Commercial Sale means, with respect to each Product, the first commercial sale in a country as part of a nationwide introduction after receipt by a Product Seller of Regulatory Approval in such country, excluding de minimis named patient and compassionate use sales.

1.34 Follow-On Product means a Product directed towards a Target that is the same Target that is targeted by a Successful Tekmira Milestone Product, a Successful Alnylam Product or a Successful Biodefense Product, as applicable, but that contains a different chemical structure for the siRNA and/or a different cationic lipid component for the LNP Formulation.

1.35 Funding Authority means the United States Department of Health and Human Services or other United States or foreign government or international agencies responsible for requesting, approving and/or funding the development and manufacture of products for biodefense purposes.

1.36 GAAP means United States generally accepted accounting principles applied on a consistent basis.

1.37 IND means a United States investigational new drug application or its equivalent or any corresponding foreign application.

1.38 Institutional Collaborator means any academic or non-profit institution or Person employed by or otherwise affiliated with such an institution that does not meet the definition of Permitted Contractor.

1.39 Know-How means biological materials and other tangible materials, information, data, inventions, practices, methods, protocols, formulas, formulations, knowledge, know-how, trade secrets, processes, assays, skills, experience, techniques and results of experimentation and testing, including without limitation pharmacological, toxicological and preclinical and clinical test data and analytical and quality control data, patentable or otherwise.

1.40 LNP Formulation means an LNP formulation, characterized by its components and its unique ratios among components.

1.41 Major Market means, individually and collectively, the United States, the European Union, Canada, the United Kingdom, France, Germany, Italy, Spain, China and Japan.

1.42 Manufacturing or Manufacture means, with respect to a Product, all activities associated with the production, manufacture and processing of such Product, and the filling, finishing, packaging, labeling, shipping, and storage of such Product, including without limitation formulation process scale-up for toxicology and clinical study use, aseptic fill and finish, stability testing, analytical development, quality assurance and quality control, and the production of the bulk finished dosage form of such Product from the siRNA and miRNA.

1.43 miRNA Product means a product containing, comprised of or based on native or chemically modified RNA oligomers designed to either (a) modulate, inhibit or interfere with a particular miRNA transcript; or (b) provide the function and/or mimic the activity of an miRNA.

1.44 Necessary Third Party IP means, with respect to any country in the Territory, on a country-by-country basis, any Patent in such country owned or controlled by a Third Party that Covers Alnylam Products and/or Tekmira Products.

1.45 Net Sales means the gross amount invoiced by Alnylam, its Affiliates or Sublicensees for Alnylam Products, or by Tekmira, its Affiliates or Sublicensees for Tekmira Products (in each case, such invoicing entity, a "Product Seller"), on sales or other dispositions in the Territory of such Products during the applicable Royalty Term to Third Parties which are not Affiliates or Sublicensees of the Product Seller, less (a) to the extent allowed and taken, sales

returns and allowances, granted or accrued, including trade, quantity and cash discounts and any other adjustments, including those granted on account of price adjustments, billing errors, rejected goods, damaged or defective goods, recalls, returns, rebates, chargebacks, reimbursements or similar payments granted or given to wholesalers or other distributors, buying groups, health care insurance carriers or other institutions; (b) adjustments arising from consumer discount programs or similar programs; (c) customs or excise duties, sales tax, consumption tax, value added tax, and other similar taxes (except income taxes) measured by the production, sale, or delivery of goods; (d) duties relating to sales and any payments in respect of sales to the United States government, any State government or any foreign government, or to any governmental authority, or with respect to any government subsidized program or managed care organization; and (e) charges for freight and insurance related to the return of Products and not otherwise paid by the customer.

In the event that a Product is sold in any country in the form of a Combination Product in any year, Net Sales of such Combination Product will be adjusted by multiplying actual Net Sales of such Combination Product in such country by the fraction A/(A+B), where A is the average Net Sales price per daily dose during such year of the Product in such country, if sold separately in such country, and B is the average Net Sales price per daily dose of any product containing the other pharmacologically active ingredients in the Combination Product in such country, if sold separately in such country. If, in a specific country, the product containing the other pharmacologically active ingredients in the Combination Product are not sold separately in such country, Net Sales will be calculated by multiplying actual Net Sales of such Combination Product by the fraction A/C, where A is the average Net Sales price per daily dose of the Product in such country and C is the average Net Sales price per daily dose of the Combination Product in such country. If, in a specific country, the Product is not sold separately in such country, Net Sales will be calculated by multiplying actual Net Sales of such Combination Product by the fraction (C-B)/C, where B is the average Net Sales price per daily dose of the product containing the other pharmacologically active ingredients in the Combination Product in such country and C is the average Net Sales price per daily dose of the Combination Product in such country. If, in a specific country, both the Product and the product containing the other pharmacologically active ingredients in the Combination Product are not sold separately in such country, the Net Sales price for the Product and the product containing the other pharmacologically active ingredients in the Combination Product will be negotiated by the Parties in good faith based upon the costs, overhead and profit as are then incurred for the Product and all similar substances then being made and marketed by the selling Party and having an ascertainable market price.

Net Sales shall be determined from books and records maintained in accordance with GAAP, consistently applied throughout the organization and across all products of the entity whose sales of Product are giving rise to Net Sales.

1.46 Party means either Alnylam or Tekmira or, solely with respect to Section 10.12, Protiva; Parties means Alnylam and Tekmira and, solely with respect to Section 10.12, Protiva.

1.47 Patent means any patent (including any reissue, extension, substitution, confirmation, re-registrations, re-examination, invalidation, supplementary protection certificate

or patents of addition) or patent application (including any provisional application, continuation, continuation-in-part or divisional).

1.48 Permitted Contractor means a Third Party that performs activities (*e.g.*, as a contractor or consultant) under a *bona fide* contract services arrangement on behalf of a Party or its Affiliates.

1.49 Person means any person or entity.

1.50 Phase I Clinical Trial means the first study of a Product in humans the primary purpose of which is the determination of safety and which may include the determination of pharmacokinetic and/or pharmacodynamic profiles in healthy individuals or patients.

1.51 Phase II Clinical Trial means (a) a study of dose exploration, dose response, duration of effect, kinetics or preliminary efficacy and safety study of a Product in the target patient population, (b) a controlled dose-ranging clinical trial to evaluate further the efficacy and safety of such Product in the target population and to define the optimal dosing regimen or (c) a clinical trial that the sponsoring Party or its Affiliate refers to in a press release as a Phase II Clinical Trial or Study.

1.52 Phase III Clinical Trial or Pivotal Trial means (a) a controlled study of a Product in patients of the efficacy and safety of such Product which is prospectively designed to demonstrate statistically whether such Product is effective and safe for use in a particular indication in a manner sufficient to obtain Regulatory Approval to market such Product or (b) a clinical trial that the sponsoring Party or its Affiliate refers to in a press release as a Phase III Clinical Trial or Study.

1.53 Product means a Tekmira Product or an Alnylam Product.

1.54 Protiva Patent means any Patent Controlled by Protiva on or after the Effective Date that was filed, or that claims priority to a Patent that was filed before April 15, 2010, but excluding Patent claims that Cover Tekmira Products, which excluded Patent claims are solely directed to PLK1, APOB, Ebola, WEE1, ALDH2 or CSN5.

1.55 Protiva Know-How means all Know-How Controlled by Protiva as of the Effective Date and that, prior to the Effective Date, was (a) disclosed to Alnylam by Protiva or (b) otherwise learned by Alnylam; provided, that Protiva Know-How shall not include Know-How learned by Alnylam solely as a result of the litigation settled pursuant to the Settlement Agreement.

1.56 Qualifying Patent means an Alnylam Patent or, if there is no Valid Claim of an Alnylam Patent remaining in the applicable sublicensed territory, any Patent Controlled by Alnylam that claims the composition of matter or method of use of a product.

1.57 Regulatory Approval means, with respect to each Product Developed and Commercialized, the receipt of sufficient authorization from the appropriate regulatory authority on a country-by-country basis to market and sell such Product in a country, including (where

necessary in a particular country prior to marketing a Product) all separate pricing and/or reimbursement approvals that may be required for marketing.

1.58 Research or Researching means identifying, evaluating, validating and optimizing Products prior to pre-IND GLP toxicology studies.

1.59 Royalty Quarter means each of the four (4) calendar quarters that begin January 1, April 1, July 1 and October 1 of each year.

1.60 siRNA means a double-stranded ribonucleic acid (RNA) composition designed to act primarily through an RNA interference mechanism that consists of either (a) two separate oligomers of native or chemically modified RNA that are hybridized to one another along a substantial portion of their lengths, or (b) a single oligomer of native or chemically modified RNA that is hybridized to itself by self-complementary base-pairing along a substantial portion of its length to form a hairpin.

1.61 siRNA Product means a product containing, comprised of or based on siRNAs or other double-stranded moieties effective in gene function modulation and designed to modulate the function of particular genes or gene products by causing degradation through RNA interference of a Target mRNA to which such siRNAs or other double-stranded moieties are complementary.

1.62 Sublicensee means (a) a Third Party to whom Alnylam has granted (or to whom another permitted sublicensee under an Alnylam Existing Sublicense grants) a sublicense pursuant to any of the Alnylam Existing Sublicenses, or (b) a Third Party to whom a Party (or another permitted sublicensee of such Party under this Agreement) grants a sublicense of all or a portion of the rights licensed to it hereunder as permitted herein.

1.63 Sublicensable Product means an Alnylam Sublicensable Product or a Tekmira Sublicensable Product.

1.64 Target means (a) a nucleic acid that encodes or is required for expression of a polypeptide (including without limitation messenger RNA and miRNA), together with all variants of such polypeptide; (b) the set of nucleic acids that encode a defined non-peptide entity, including a microorganism, virus, bacterium or single cell parasite; provided that the entire genome of a microorganism, virus, bacterium, or single cell parasite shall be regarded as a single Target; or (c) a naturally occurring interfering RNA or miRNA or precursor thereof.

1.65 Tekmira Additional Target means a Tekmira Additional Exclusive Target or a Tekmira Additional Non-Exclusive Target.

1.66 Tekmira Combined Licensed Technology means, collectively, the Protiva Patents, the Protiva Know-How, the Tekmira Patents and the Tekmira Know-How.

1.67 Tekmira Exclusive Target means ALDH2 or any of the Tekmira Additional Exclusive Targets.

1.68 Tekmira Field means the use of siRNA Products directed to a Tekmira Target for the prevention, treatment or palliation of human disease, and related Research, Development and Commercialization activities.

1.69 Tekmira Know-How means all Know-How, other than Protiva Know-How, Controlled by Tekmira as of the Effective Date and that, prior to the Effective Date, was (a) disclosed by Tekmira to Alnylam or (b) otherwise learned by Alnylam; provided, that Tekmira Know-How shall not include Know-How learned by Alnylam solely as a result of the litigation settled pursuant to the Settlement Agreement.

1.70 Tekmira Manufacturing Documents means the documents identified in Schedule 1.70.

1.71 Tekmira Milestone Product means any Tekmira Product Covered by a Valid Claim within the Alnylam Patents and that is directed to a Tekmira Non-Exclusive Target other than Ebola.

1.72 Tekmira Non-Exclusive Target means any of the following Targets: PLK1, APOB, Ebola, WEE1, CSN5, or any of the Tekmira Additional Non-Exclusive Targets.

1.73 Tekmira Patent means any Patent, other than a Protiva Patent, UBC Patent or Category 1 Patent, that is Controlled by Tekmira on or after the Effective Date and that was filed, or that claims priority to a Patent that was filed, before April 15, 2010.

1.74 Tekmira Product means an siRNA Product Researched, Developed or Commercialized by Tekmira, its Affiliates or Sublicensees that is directed to a Tekmira Target.

1.75 Tekmira Royalty-Bearing Patent means any Patent within the Tekmira Combined Licensed Technology, any Category 1 Patent, any Category 2 Patent as to which a Tekmira employee is listed as an inventor, any Category 3 Patent as to which a Tekmira employee is listed as an inventor, and any UBC Patent.

1.76 Tekmira Sublicensable Product means a Product that has been developed by Tekmira or its Affiliates for which (a) a Target has been identified, and a potential therapeutic intervention described, and (b) one (1) or more oligonucleotide(s) have been screened in *in vitro* studies and (c) non-GLP rodent pharmacology data has been generated.

1.77 Tekmira Target means a Tekmira Exclusive Target or a Tekmira Non-Exclusive Target.

1.78 Tekmira-UBC License Agreement means that certain license agreement between Tekmira and UBC, dated effective July 1, 1998, as amended by Amendment Agreement between Tekmira and UBC dated effective July 11, 2006, and Second Amendment Agreement dated effective August 14, 2007.

1.79 Territory means worldwide.

1.80 Third Party means any Person other than Tekmira, Alnylam or any of their respective Affiliates.

1.81 UBC Patent means a Patent sublicensed to Alnylam pursuant to the UBC Sublicense and that was filed, or that claims priority to a Patent that was filed, before April 15, 2010.

1.82 Valid Claim means (a) any claim in an issued and unexpired patent within the Alnylam Patents or the Tekmira Royalty-Bearing Patents, as applicable, that has not been held unenforceable, unpatentable or invalid by a decision of a court or other governmental agency of competent jurisdiction, which decision is unappealable or unappealed within the time allowed for appeal, and which has not been admitted by the holder of the patent to be invalid or unenforceable through reissue, re-examination, or disclaimer or otherwise and (b) a patent application within the Alnylam Patents or the Tekmira Royalty-Bearing Patents, as applicable, a claim of which has been pending less than [**] years and which claim has not been cancelled, withdrawn or abandoned or finally rejected by an administrative agency action from which no appeal can be taken.

Additional Defined Terms	Section Reference
AAA	10.2
Agreement	PREAMBLE
AlCana	RECITALS
Alnylam	PREAMBLE
Alnylam Additional Exclusive Target	3.2
Alnylam Indemnitee	7.1
Alnylam-Protiva CLA	RECITALS
Alnylam-Tekmira LCA	RECITALS
Ascletis	4.6
Code	2.7
Competitive Infringement	5.4(a)
Effective Date	PREAMBLE
IP Management Terms	5.1
Lead Development Candidate	1.17
LNP	RECITALS
LNP Improvements	2.2(d)
LNP/SNALP Technology	RECITALS
Losses	7.1
miRNA	RECITALS
Manufacturing Agreements	RECITALS
Prior Cross-License Agreements	RECITALS
Product Seller	1.45
Protiva	PREAMBLE
RNAi	RECITALS
Royalty Term	4.7
Settlement Agreement	RECITALS

Additional Defined Terms	Section Reference
Sponsored Research Agreement	RECITALS
Successful Alnylam Product	4.5
Successful Biodefense Product	4.4
Successful Tekmira Milestone Product	4.1
Supplemental Agreement	RECITALS
Tekmira	PREAMBLE
Tekmira Additional Exclusive Target	3.1
Tekmira Additional Non-Exclusive Target	3.1
Tekmira Indemnitee	7.2
UBC	RECITALS
UBC Sublicense	RECITALS

ARTICLE II- LICENSE GRANTS AND RELATED RIGHTS

2.1 License Grants to Tekmira.

(a) Subject to the terms and conditions of this Agreement and the Alnylam Existing In-Licenses, Alnylam hereby grants to Tekmira and its Affiliates an exclusive right and license under the Alnylam Licensed Technology to Research, Develop and Commercialize Tekmira Products directed to any Tekmira Exclusive Target in the Tekmira Field in the Territory.

(b) Subject to the terms and conditions of this Agreement and the Alnylam Existing In-Licenses, Alnylam hereby grants to Tekmira and its Affiliates a non-exclusive right and license under the Alnylam Licensed Technology to Research, Develop and Commercialize Tekmira Products directed to any Tekmira Non-Exclusive Target in the Tekmira Field in the Territory.

(c) The licenses set forth in this Section 2.1 include the right to grant sublicenses as provided in, and subject to, Section 2.3 below.

2.2 License Grants to Alnylam.

(a) Subject to the terms and conditions of this Agreement, Tekmira hereby grants to Alnylam and its Affiliates an exclusive right and license under the Tekmira Combined Licensed Technology and the Category 1 Patents to Research, Develop and Commercialize Alnylam Products directed to any Alnylam Exclusive Target in the Alnylam Field in the Territory.

(b) Subject to the terms and conditions of this Agreement, Tekmira grants to Alnylam and its Affiliates a non-exclusive right and license under the Tekmira Combined Licensed Technology and the Category 1 Patents to Research, Develop and Commercialize Alnylam Products directed to any Alnylam Non-Exclusive Target in the Alnylam Field in the Territory.

(c) Subject to the terms and conditions of this Agreement, Tekmira grants to Alnylam and its Affiliates a non-exclusive right and license (without the right to grant sublicenses outside

of the Alnylam Field) under the Category 1 Patents for any and all purposes, both in the Alnylam Field and outside of the Alnylam Field, in the Territory. The license granted pursuant to this Section 2.2(c) shall be fully paid-up and royalty-free outside the Alnylam Field.

(d) Subject to the terms and conditions of this Agreement, Tekmira grants to Alnylam and its Affiliates a non-exclusive, non-sublicensable, fully paid-up, royalty-free right and license under the Tekmira Combined Licensed Technology and the Category 1 Patents to research, develop, make, have made and use improvements to such technology and inventions claimed or covered by such Patents ("LNP Improvements") and to research, develop, make, have made, use and commercialize LNP Improvements. As between the Parties, Alnylam shall own all LNP Improvements made by Alnylam and its Affiliates pursuant to the license granted under this Section 2.2(d); provided, however, that such ownership of LNP Improvements shall not extinguish or alter any of Alnylam's obligations to Tekmira for any products that are Alnylam Products.

(e) The licenses set forth in subsections (a), (b) and (c) of this Section 2.2 include the right to grant sublicenses as provided in, and subject to, Section 2.3 below.

2.3 Sublicensing.

(a) The licenses granted to Tekmira in Section 2.1 include the right for Tekmira to grant sublicenses, but only on a Tekmira Sublicensable Product-by-Tekmira Sublicensable Product basis, to Third Parties to Research, Develop and/or Commercialize Tekmira Products that are Tekmira Sublicensable Products. Tekmira shall require that the terms of any sublicense under its rights in this Agreement are fully in compliance with the terms and conditions of this Agreement and of the Alnylam Existing In-Licenses governing Alnylam's rights under the Alnylam Licensed Technology.

(b) The licenses granted to Alnylam in Section 2.2(a), Section 2.2(b) and Section 2.2(c) include the right for Alnylam to grant sublicenses in the Alnylam Field, but only on a Alnylam Sublicensable Product-by-Alnylam Sublicensable Product basis, to Third Parties to Research, Develop and/or Commercialize Alnylam Products that are Alnylam Sublicensable Products. Alnylam shall require that the terms of any sublicense under its rights in this Agreement are fully in compliance with the terms and conditions of this Agreement.

(c) Any sublicense granted by a Party hereunder shall be subject and subordinate to the terms and conditions of this Agreement and shall contain terms and conditions consistent with those in this Agreement. The sublicensing Party shall assume full responsibility for the performance of all obligations and observance of all terms herein under the licenses granted to it and will itself pay and account to the other Party for all payments due under such licenses by reason of any such sublicense. If a sublicensing Party becomes aware of a material breach of any sublicense by a Sublicensee, the sublicensing Party shall promptly notify the other Party of the particulars of same and take all reasonable efforts to enforce the terms of such sublicense.

(d) Unless otherwise provided in this Agreement, the sublicensing Party will notify the other Party within [**] days after execution of a sublicense entered into hereunder and

provide a copy of the fully executed sublicense agreement to the other Party within the same time frame (with such reasonable redactions as the sublicensing Party may make, provided that such redactions do not include provisions necessary to demonstrate compliance with the requirements of this Agreement), which shall be treated as Confidential Information of the sublicensing Party under Article VI; and provided further that the other Party may disclose such agreement(s) to Third Parties under confidence if and to the extent required in order to comply with such other Party's contractual obligations under both this Agreement and Third Party agreements.

(e) Tekmira hereby waives the foregoing sublicensing restrictions and requirements of Section 2.2(c), Section 2.2(d) and this Section 2.3 with respect to the Alnylam Existing Sublicenses. In addition, to the extent that Alnylam as of the Effective Date has licensed or sublicensed any Patent or Know-How Controlled by Tekmira as of the Effective Date to any Third Party pursuant to any Alnylam Existing Sublicense, or granted any Third Party pursuant to any Alnylam Existing Sublicense any option to obtain a license or sublicense under any Patent or Know-How Controlled by Tekmira, the rights of the applicable Third Party shall not be affected by this Agreement, and if such Third Party Develops or Commercializes Alnylam Products, then Tekmira will be entitled to milestone payments and royalties with respect thereto as set forth in this Agreement. Alnylam agrees that it will not grant any additional options, licenses or sublicenses under Alnylam Patents, Tekmira Combined Licensed Technology, UBC Patents or Category 1 Patents to AlCana to Research, Develop or Commercialize siRNA Products without the prior written consent of Tekmira or enter into any additional contractual obligations to indemnify AlCana as to AlCana's practice of the Alnylam Patents, Tekmira Combined Licensed Technology, UBC Patents or Category 1 Patents to Research, Develop or Commercialize siRNA Products.

(f) Notwithstanding Sections 2.3(a) and 2.3(b), either Party may utilize Permitted Contractors and Institutional Collaborators to Research and/or Develop their respective Products, whether or not such Products have become Sublicensable Products; provided that (i) such Party does not grant any such Permitted Contractor or Institutional Collaborator any license to Commercialize Products that are not Sublicensable Products and (ii) no Party shall share any of the other Party's Confidential Information with such Permitted Contractor or Institutional Collaborator unless such Third Party shall have executed a binding confidentiality agreement containing reasonably customary terms and conditions.

2.4 Coordination with Supplemental Agreement. Tekmira and Alnylam hereby agree that the terms of this Agreement and the Settlement Agreement (and the Binding Term Sheet attached thereto) extinguish, supersede, and replace the rights and obligations of Tekmira, Alnylam, and AlCana under the Supplemental Agreement solely as between and among Tekmira, Alnylam, and AlCana; provided, however, Alnylam's payment obligations to UBC and AlCana under the Supplemental Agreement and Sponsored Research Agreement shall survive the execution of this Agreement and the Settlement Agreement (and the Binding Term Sheet attached thereto), and shall also survive any termination of the Supplemental Agreement or Sponsored Research Agreement, in each case for the duration of the applicable Royalty Term (as defined in the Sponsored Research Agreement). Subject to the terms and conditions of the Settlement Agreement and any subsequent agreement(s) among Alnylam, Tekmira, UBC and

AlCana, the rights and obligations of UBC under the Supplemental Agreement and Sponsored Research Agreement shall be maintained. Notwithstanding any of the foregoing, nothing in this section 2.4 shall operate to relieve Alnylam of its obligation to comply with its payment or royalty obligations to UBC or AlCana, either directly or indirectly, under the Supplemental Agreement or Sponsored Research Agreement.

2.5 Covenants Not to Sue. Alnylam hereby covenants that it and its Existing Affiliates will not initiate any legal suit against Tekmira or any of its Existing Affiliates asserting that:

(a) any internal Research performed solely by Tekmira or its Existing Affiliates (and not with any Third Party) and solely for the purpose of identifying a Target for selection as a Tekmira Additional Target hereunder during the period starting on the Effective Date and continuing until the earlier of (i) the [**] anniversary of the Effective Date and (ii) such date that Tekmira completes its selection of the Tekmira Additional Targets pursuant to Article III; or

(b) the formulating in LNP Formulations by Tekmira or any of its Existing Affiliates of oligonucleotides controlled by any *bona fide* Third Party pharmaceutical collaborator on behalf of such Third Party and solely for Research (but not Development or Commercialization);

constitutes infringement and/or misappropriation of the Alnylam Licensed Technology. For clarity, the Parties agree that the covenants set forth in this Section 2.5 do not extend to any Third Party.

2.6 Retained Rights. Each Party expressly retains any rights not expressly granted to the other Party under this Article II (or otherwise under this Agreement).

2.7 Rights in Bankruptcy. All licenses and rights to licenses granted under or pursuant to this Agreement by a Party to other Party are, and shall otherwise be deemed to be, for purposes of Section 365(n) of the United States Bankruptcy Code (the "Code"), licenses of rights to "intellectual property" as defined under Section 101(35A) of the Code. The Parties agree that each Party, as a licensee of such rights under this Agreement, shall retain and may fully exercise all of its rights and elections under the Code, and that upon commencement of a bankruptcy proceeding by or against the other Party under the Code, such Party shall be entitled to a complete duplicate of, or complete access to (as such Party deems appropriate), any such intellectual property and all embodiments of such intellectual property. Such intellectual property and all embodiments thereof shall be promptly delivered to such Party (a) upon any such commencement of a bankruptcy proceeding upon written request therefor by such Party, unless such other Party elects to continue to perform all of its obligations under this Agreement or (b) if not delivered under (a) above, upon the rejection of this Agreement by or on behalf of such other Party upon written request therefor by such Party. The foregoing provisions are without prejudice to any rights such Party may have arising under the Code or other applicable law.

ARTICLE III- SELECTION OF ADDITIONAL TARGETS

3.1 Tekmira Additional Targets. Subject to Section 3.3, during the period beginning on the Effective Date and ending on the [**] anniversary thereof, Tekmira may select (i) up to two (2) Targets (other than the Alnylam Exclusive Targets) that shall each become a "Tekmira Additional Exclusive Target" and (ii) up to five (5) Targets (other than the Alnylam Exclusive Targets) that shall each become a "Tekmira Additional Non-Exclusive Target". For clarity, the Parties acknowledge that such seven (7) Tekmira Additional Targets shall be in addition to the one (1) Tekmira Exclusive Target and the five (5) Tekmira Non-Exclusive Targets selected as of the Effective Date.

3.2 Alnylam Additional Exclusive Targets. Subject to Section 3.3, during the period beginning on the Effective Date and ending on the [**] anniversary thereof, Alnylam may select up to five (5) Targets (other than the Tekmira Targets) that shall each become an "Alnylam Additional Exclusive Target". For clarity, the Parties acknowledge that the five (5) Alnylam Exclusive Additional Targets shall be in addition to the Alnylam Existing Exclusive Targets.

3.3 Selection Process. The following process shall apply to the selection of Tekmira Additional Targets and Alnylam Additional Exclusive Targets.

(a) As to Targets that are peptide entities, the selecting Party shall initially notify the other Party in writing of the NCBI Gene ID number (or, if a NCBI Gene ID number is not available, the specific sequence of the proposed Target) of each Target nominated by the selecting Party for selection as an additional Target. As to Targets that are non-peptide entities, the selecting Party shall initially notify the other Party in writing of the non-peptide entity. Within [**] Business Days following the other Party's receipt of a notice nominating a Target, such other Party shall notify the selecting Party in writing whether such Target is either: (i) subject to a binding contractual obligation to a Third Party that would be breached by the inclusion of such Target as an additional Target under these terms, or (ii) the subject of an Active Internal Development Program at such other Party and such Active Internal Development Program was in existence as such prior to the receipt of such notice from the selecting Party and such other Party determines in good faith that it intends to continue such Active Internal Development Program, and so notifies the selecting Party. If neither of these criteria applies, the Target shall be considered to have been successfully nominated as a Tekmira Additional Non-Exclusive Target, Tekmira Additional Exclusive Target, or Alnylam Additional Exclusive Target, as applicable.

(b) If a Target submitted to Alnylam is not available for license as a Tekmira Additional Target pursuant to subsection (a) above, then Tekmira may nominate an additional Target as a Tekmira Additional Target, until two (2) Tekmira Additional Exclusive Targets and five (5) Tekmira Additional Non-Exclusive Targets have been identified and successfully nominated pursuant to the foregoing procedure. Any Target successfully nominated pursuant to the foregoing procedure shall be a Tekmira Additional Target.

(c) If a Target submitted to Tekmira is not available for license as an Alnylam Additional Exclusive Target pursuant to subsection (a) above, then Alnylam may nominate an

additional Target as an Alnylam Additional Exclusive Target, until five (5) Alnylam Additional Exclusive Targets have been identified and successfully nominated pursuant to the foregoing procedure. Any Target successfully nominated pursuant to the foregoing procedure shall be an Alnylam Exclusive Additional Target.

ARTICLE IV- FINANCIAL PROVISIONS

4.1 Manufacturing Opt-Out Payment. Within ten (10) Business Days after the Effective Date, Alnylam shall pay Tekmira a fee of thirty million U.S. dollars ($30,000,000), which amount shall constitute full consideration for the termination of and release of Alnylam from all of Alnylam's obligations under the Manufacturing Agreements, including without limitation the obligations to obtain materials and/or services from Tekmira, and the rights to Manufacture and have Manufactured Alnylam Products included in the Development and Commercialization rights granted to Alnylam pursuant to Sections 2.2(a) and 2.2(b). Based on Tekmira's provision to Alnylam of a completed Form W-8BEN, Alnylam agrees that it will not withhold taxes from the payment under this Section 4.1.

4.2 Restructuring Payment. Within ten (10) Business Days after the Effective Date, Alnylam shall pay Tekmira a fee of thirty-five million U.S. dollars ($35,000,000), which amount shall constitute payment for the termination of the Prior Cross-License Agreements and the Parties' rights and obligations thereunder, as well as the restructuring of certain milestone payments and royalty rates for certain Alnylam Products as set forth in Sections 4.6 and 4.9(d). Based on Tekmira's provision to Alnylam of a completed Form W-8BEN, Alnylam agrees that it will not withhold taxes from the payment under this Section 4.2.

4.3 Milestones with Respect to Tekmira Milestone Products. On a Tekmira Milestone Product-by-Tekmira Milestone Product basis, payments will be payable by Tekmira to Alnylam based upon the achievement of certain milestone events as set forth in the table below (all references are to U.S. dollars). Tekmira will provide written notice to Alnylam of the occurrence of a milestone event within [**] Business Days, and pay the indicated milestone fee to Alnylam within [**] days, after the occurrence of the relevant event.

Capitalized terms in the chart below shall be read in context to apply to Tekmira Milestone Products; provided, however, that each milestone payment will be payable no more than once in respect of any given Tekmira Milestone Product.

Milestone Event	Milestone Fee
[**]	[**]
[**]	[**]
[**]	[**]
[**]	[**]

Milestone Event	Milestone Fee
[**]	[**]
[**]	[**]

If one or more milestone events set out above are skipped for any reason, the payment for such skipped milestone event(s) will be due at the same time as the payment for the next achieved milestone event. The milestone payments described above shall be payable only once in relation to each Tekmira Milestone Product that achieves Regulatory Approval in a Major Market (each, a "Successful Tekmira Milestone Product"). Therefore, unless and until there is a Successful Tekmira Milestone Product directed to a particular Target, any of the milestone payments made by Tekmira under this Section in connection with a Tekmira Milestone Product directed to such Target shall be fully creditable against the repeated achievement of such milestone event by any other Tekmira Milestone Product directed to such Target. However, in the event that there is a Successful Tekmira Milestone Product directed to a Target and Tekmira subsequently begins to Develop or continues to develop a Follow-On Product then, if and when any of the milestone events set out above is thereafter achieved for such Follow-On Product, in addition to the milestone payment for such milestone event, there will also be due and payable all of the milestone payment(s) for any such milestones that were achieved but not paid for such Follow-On Product prior to the achievement of Regulatory Approval in a Major Market of a Successful Tekmira Milestone Product with respect to such Target.

4.4 Milestones with Respect to Biodefense Targets. The milestone fees payable by Alnylam to Tekmira with respect to Alnylam Products directed to Biodefense Targets that are not intended for sale, directly or indirectly, to a Funding Authority shall be as set forth in Section 4.4. The milestone fees payable by Alnylam to Tekmira with respect to Alnylam Products Covered by a Valid Claim within the Tekmira Royalty-Bearing Patents that are directed to Biodefense Targets which are intended for sale, directly or indirectly, to a Funding Authority shall be payable on an Alnylam Product-by-Alnylam Product basis as follows, subject to Section 4.6:

Milestone Event	Milestone Fee
[**]	[**]
[**]	[**]
[**]	[**]

In the event one or more milestone events set out above are skipped for any reason, the payment for such skipped milestone event(s) will be due at the same time as the payment for the next achieved milestone event. The milestone payments described above shall be payable only once in relation to each Alnylam Royalty Product directed to a Biodefense Target that achieves First Commercial Sale in a Major Market (each, a "Successful Biodefense Product"). Therefore,

unless and until there is a Successful Biodefense Product directed to a particular Biodefense Target, any of the milestone payments made by Alnylam under this Section in connection with an Alnylam Product directed to such Biodefense Target shall be fully creditable against the repeated achievement of such milestone event by any other Alnylam Product directed to such Biodefense Target. However, in the event that there is a Successful Biodefense Product directed to a Biodefense Target and Alnylam subsequently begins to Develop or continues to Develop a Follow-On Product, then, if and when any of the milestone events set out above is thereafter achieved for such Follow-On Product directed to such Biodefense Target, in addition to the milestone payment for such milestone event, there will also be due and payable all of the milestone payment(s) for any such milestones that were achieved but not paid for such Follow-On Product prior to the achievement of Approval in a Major Market of a Successful Biodefense Product with respect to such Biodefense Target.

4.5 Milestones with Respect to Alnylam Products. On an Alnylam Product-by-Alnylam Product basis, and except as otherwise set forth in Sections 4.4 and 4.6, payments will be payable by Alnylam to Tekmira based on the achievement of certain milestone events as set forth in the table below (all references are to U.S. dollars) with respect to any Alnylam Product that is Covered by a Valid Claim within the Tekmira Royalty-Bearing Patents. Alnylam will provide written notice to Tekmira of the occurrence of a milestone event within [**] Business Days, and pay the indicated milestone fee to Tekmira within [**] days, after the occurrence of the relevant event.

Capitalized terms in the chart below shall be read in context to apply to Alnylam Products; provided, however, that each milestone payment will be payable no more than once in respect of any given Alnylam Product.

Milestone Event	Milestone Fee
[**]	[**]
[**]	[**]
[**]	[**]
[**]	[**]
[**]	[**]
[**]	[**]

If one or more milestone events set out above are skipped for any reason, the payment for such skipped milestone event(s) will be due at the same time as the payment for the next achieved milestone event. The milestone payments described above shall be payable only once in relation to each Alnylam Product that achieves Regulatory Approval in a Major Market (each, a "Successful Alnylam Product"). Therefore, unless and until there is a Successful Alnylam Product directed to a particular Target, any of the milestone payments made by Alnylam under

this Section in connection with an Alnylam Product directed to such Target shall be fully creditable against the repeated achievement of such milestone event by any other Alnylam Product directed to such Target. However, in the event that there is a Successful Alnylam Product directed to a Target and Alnylam subsequently begins to Develop or continues to Develop a Follow-On Product, if and when any of the milestone events set out above is thereafter achieved for such Follow-On Product directed to such Target, in addition to the milestone payment for such milestone event, there will also be due and payable all of the milestone payment(s) for any such milestones that were achieved but not paid for such Follow-On Product prior to the achievement of Regulatory Approval in a Major Market of a Successful Alnylam Product directed to such Target.

4.6 Milestones for Certain Alnylam Existing Exclusive Targets. In lieu of any milestone payments under Sections 4.4 and 4.5 with respect to all Alnylam Products that are directed to any of the Alnylam Existing Exclusive Targets, a milestone payment will be due by Alnylam to Tekmira solely for the first achievement of each of the corresponding milestone events set forth in the table below (all references are to U.S. dollars) by the applicable Alnylam Product identified below. Alnylam will provide written notice to Tekmira of the occurrence of a milestone event within [**] Business Days, and pay the indicated milestone fee to Tekmira within [**] days, after the occurrence of the relevant milestone event. For the avoidance of doubt, each milestone fee set forth below will be payable no more than once.

Milestone Event	Milestone Fee
Dosing of first patient in a Phase III Clinical Trial for ALN-TTR; provided that such ALN-TTR is Covered by a Valid Claim within the Tekmira Royalty-Bearing Patents	$5,000,000
Tekmira has [**] for clinical development of ALN-VSP in China either by (i) provision of direct Manufacturing services, including but not limited to the clinical trial drug product material and associated manufacturing and regulatory information necessary and sufficient for the initiation of a clinical trial in China or Korea, or (ii) the transfer of necessary Manufacturing process technology used to produce batch [**] of ALN-VSP for Alnylam clinical trials and sufficient to produce at least one (1) batch of ALN-VSP suitable for clinical trials in China or Korea.	$5,000,000

In addition to the corresponding milestone fee, all expenses actually incurred by Tekmira for the activities set forth in clauses (i) and (ii) in the second milestone listed in the above table shall be paid by [**].

4.7 Royalty Term. Royalties shall be payable hereunder on a Product-by-Product and country-by-country basis commencing on the First Commercial Sale of a Product in a country and continuing during any period in which (a) in the case of Alnylam Products, a Valid Claim within the Tekmira Royalty-Bearing Patents Covers the applicable Alnylam Product in such country of sale, or (b) in the case of Tekmira Products, a Valid Claim within the Alnylam Patents Covers the applicable Tekmira Product in such country of sale (such period, as applicable, the "Royalty Term"). Upon the expiration of the Royalty Term applicable to a given Product and country, the license granted under Section 2.1(a), Section 2.1(b), Section 2.2(a) or Section 2.2(b), as applicable, shall become fully paid-up, royalty-free, non-exclusive, perpetual and irrevocable with respect to such Product in such country.

4.8 Royalties Payable by Tekmira. During the applicable Royalty Term, Tekmira shall pay running royalties on Net Sales of Tekmira Products Covered by one or more Valid Claims of any Alnylam Patent in the applicable country of sale in accordance with the applicable running royalty rates set out in the table below (all references are to U.S. dollars):

Aggregate Annual Net Sales	Royalty Rate
[**]	[**]%
[**]	[**]%
[**]	[**]%
[**]	[**]%

No royalties will be payable more than once by Tekmira with respect to any single unit of Tekmira Product.

4.9 Royalties on Alnylam Products. During the applicable Royalty Term, Alnylam shall pay running royalties on Net Sales of Alnylam Products Covered by one or more Valid Claims of the Tekmira Royalty-Bearing Patents in the applicable country of sale, as follows (all references are to U.S. dollars), whether or not such Alnylam Products are directed to Biodefense Targets, subject to Section 4.9(d):

(a) Where the Net Sales are those of, and are invoiced by, any one of the following:

(i) Alnylam or its Affiliate;

(ii) Roche;

(iii) Regulus Therapeutics under a sub-license granted by Alnylam; or

(iv) another sub-licensee under a sub-license granted by Alnylam in connection with, and solely for the purpose of, a Bona Fide Collaboration;

the applicable running royalty rates shall be as set out in the table below:

Aggregate Annual Net Sales	Royalty Rate
[**]	[**]%
[**]	[**]%
[**]	[**]%

(b) In all other cases, the applicable running royalty rates shall be set out in the table below:

Aggregate Annual Net Sales	Royalty Rate
[**]	[**]%
[**]	[**]%
[**]	[**]%
[**]	[**]%

(c) No royalties will be payable more than once by Alnylam with respect to any single unit of Alnylam Product.

(d) The royalty rate payable on Net Sales of Alnylam Products Covered by one or more Valid Claims of the Tekmira Royalty-Bearing Patents in the applicable country of sale that are directed to any of the Alnylam Existing Exclusive Targets shall be reduced by [**] percent ([**]%) of Aggregate Annual Net Sales at all tiers set forth in the tables in subsections (a) and (b) above (*e.g.*, where such a table indicates a royalty rate of [**]%, the royalty rate that would apply instead with respect to Net Sales of Alnylam Products directed to any of the Alnylam Existing Exclusive Targets shall be [**]%).

4.10 Royalty Reduction. The royalties due under Section 4.8 or 4.9 above, as applicable, may be reduced on a country-by-country basis in the Territory by the amount of royalties paid or payable with respect to Necessary Third Party IP; provided, however, that royalties due under Section 4.8 or 4.9 above, as applicable, may not be reduced by more than [**] of the royalties otherwise due (and will not in any case be reduced below [**] of the amount of royalties that would otherwise be due, *e.g.*, for Net Sales of a Tekmira Product up to and including $[**], the minimum effective royalty rate would be [**]%). For purposes of illustration only, if Aggregate Annual Net Sales of a Tekmira Product are $[**] and royalties due to Third Parties in respect of the sale of such product total [**] percent ([**]%) of Net Sales (or $[**]), royalties due to Alnylam may be reduced only by $[**] which is determined as follows: maximum reduction is [**] of the royalty due on Net Sales of $[**], calculated by [**]. For the avoidance of doubt, royalties paid or payable by Alnylam pursuant to the Supplemental Agreement or the Sponsored Research Agreement shall constitute royalties paid or payable to Third Parties with respect to Necessary Third Party IP for purposes of this Section 4.10, notwithstanding any assignment or transfer of the rights to receive such payments to Tekmira or any of its Affiliates; provided, however, that royalties paid or payable pursuant to the Supplemental Agreement or the Sponsored Research Agreement on Aggregate Annual Net Sales greater than $[**] of any Alnylam Product, where such royalties are paid or payable only because such Alnylam Product is Covered by a Valid Claim within the Category 1 Patents (*i.e.*, where such royalties would not be paid or payable based on other patent rights in the absence of such Category 1 Patents), shall not result in a reduction to royalties under this Agreement pursuant to this Section 4.10 of more than [**]% of such Aggregate Annual Net Sales greater than $[**] in respect of any such Alnylam Product.

4.11 Third Party License Payments. Tekmira shall pay 100% of all royalties, license fees, milestones and similar payments (if any) payable to any Third Party under its existing in-licenses, if any, for the rights to Tekmira Combined Licensed Technology licensed to Alnylam under this Agreement. In addition, notwithstanding the differences between the milestones and royalties payable by Alnylam under this Agreement and the milestones and royalties that were payable under the Alnylam-Tekmira LCA, Tekmira remains solely responsible for, and agrees to pay to UBC, any and all amounts payable to UBC pursuant to the Tekmira-UBC License Agreement, including, without limitation, any and all amounts payable to UBC in connection with Alnylam's exercise of its rights under the UBC Sublicense and any and all amounts paid by Alnylam to Tekmira under this Agreement or the UBC Sublicense. Alnylam shall pay 100% of all royalties, license fees, milestones and similar payments (if any) payable to any Third Party under any Alnylam Existing In-License for the rights to Alnylam Licensed Technology licensed to Tekmira under this Agreement.

4.12 Reports. As to each Royalty Quarter commencing with the Royalty Quarter during which the First Commercial Sale occurs with respect to a Tekmira Product, in the case of Tekmira as the reporting Party, or with respect to an Alnylam Product, in the case of Alnylam as the reporting Party, within [**] days after the end of such Royalty Quarter (if the reporting Party has not entered into an agreement with a Sublicensee) and within [**] days after the receipt by the reporting Party from a Sublicensee of such Sublicensee's report, as required by such Sublicensee's sublicense for each Royalty Quarter (if the applicable Party has entered into an agreement with a Sublicensee), each reporting Party will deliver to the other Party to this

Agreement a written report showing, on a country-by-country basis, the Net Sales of Products calculated under GAAP and its royalty obligation for such quarter with respect to such Net Sales under this Agreement together with wire transfer of an amount equal to such royalty obligation. All Net Sales will be segmented in each such report according to sales by the selling Party and each of its Affiliates and Sublicensees, as well as on a product-by-product basis, including the rates of exchange used to convert Net Sales to United States Dollars from the currency in which such sales were made. For the purposes of this Agreement, the rates of exchange to be used for converting Net Sales to United States Dollars will be the simple average of the selling and buying rates of U.S. dollars published in *The Wall Street Journal East Coast Edition* for the last Business Day of the Royalty Quarter covered by the report.

4.13 Tax Withholding. Each paying Party will use all reasonable and legal efforts to reduce tax withholding with respect to payments to be made to the other Party under this Agreement. Notwithstanding such efforts, subject to Sections 4.1 and 4.2, if the paying Party concludes that tax withholdings under the laws of any country are required with respect to payments, the paying Party will make the full amount of the required payment to such other Party after any tax withholding. In any such case, the paying Party shall provide such other Party with a written explanation of such withholding and original receipts or other evidence reasonably desirable and sufficient to allow it to document such tax withholdings for purposes of claiming foreign tax credits and similar benefits.

4.14 Payments. Unless otherwise agreed by the Parties, all payments required to be made under this Agreement will be made in United States Dollars via wire transfer to an account designated in advance by the receiving Party.

4.15 Audits. At any given point in time, each Party will have on file and will require its Affiliates and Sublicensees to have on file complete and accurate records for the last [**] years of all Net Sales of Products for which it is the paying Party. The other Party to this Agreement will have the right, [**] during each twelve (12) month period, to retain at its own expense an independent qualified certified public accountant reasonably acceptable to such Party to review such records solely for accuracy and for no other purpose upon reasonable notice and under a written obligation of confidentiality, during regular business hours. If the audit demonstrates that the payments owed under this Agreement have been understated, the audited Party will pay the balance to such other Party together with interest on such amounts from the date on which such payment obligation accrued at a rate equal to the then current [**]-day United States dollar LIBOR rate plus [**] percent per annum. If the underpayment is greater than five percent of the amount owed, then the audited Party will reimburse such other Party for its reasonable out-of-pocket costs of the audit. If the audit demonstrates that the payments owed under this Agreement have been overstated, such other Party to this Agreement will credit the balance against the next payment due from the audited Party (without interest).

ARTICLE V- INTELLECTUAL PROPERTY

5.1 Category 1, 2 and 3 Patents. Subject to the terms and conditions set forth in the Exhibit A attached hereto (the "IP Management Terms"):

(a) Alnylam hereby assigns to Tekmira all of Alnylam's right, title and interest in and to the Category 1 Patents, subject to any existing rights granted by Alnylam to Third Parties under the Category 1 Patents, including but not limited to such rights granted by Alnylam to UBC and AlCana under the Supplemental Agreement and rights granted under the Alnylam Existing Sublicenses; provided, however, that such assignment shall exclude any right to enforce the Category 1 Patents with respect to any alleged infringing activities by Alnylam and/or any of its licensees that occurred prior to the Effective Date.

(b) In the event that Tekmira obtains any ownership interest in any Category 2 Patent or Category 3 Patent pursuant to the inventorship determination made under Sections 5 and 6 of the IP Management Terms, Tekmira shall and hereby does assign to Alnylam all of Tekmira's right, title and interest in and to such Category 2 Patent or Category 3 Patent, as applicable.

(c) Each Party agrees to execute such further documents and take such further actions as the other Party may reasonably request in order to give effect to the assignments contemplated under subsections (a) and (b) above.

(d) The filing, prosecution and maintenance of Category 1 Patents, Category 2 Patents and Category 3 Patents shall be governed by the applicable provisions of the IP Management Terms.

5.2 Prosecution and Maintenance of Other Patents. Subject to the IP Management Terms, Alnylam will have the sole right and responsibility, at Alnylam's discretion and at its expense, to file, prosecute and maintain patent protection in the Territory for all Patents (other than Category 2 Patents, and Category 3 Patents) within the Alnylam Licensed Technology. Tekmira will have the sole right and responsibility, at Tekmira's discretion and at its expense, to file, prosecute and maintain patent protection in the Territory for all Patents (other than Category 1 Patents) within the Tekmira Combined Licensed Technology.

5.3 Third Party Infringement of Alnylam's Patents.

(a) Each Party will promptly report in writing to the other Party during the Term any known or suspected infringement by a Third Party of any of the Alnylam Patents of which such Party becomes aware, as such infringement relates to Research, Development or Commercialization of Products directed at any Tekmira Target, or any Tekmira Product, and will provide the other Party with all available evidence supporting such infringement.

(b) Alnylam will have the sole and exclusive right to initiate an infringement or other appropriate suit in the Territory with respect to infringements or suspected infringements of any of the Alnylam Patents and to any and all recoveries obtained in connection therewith.

(c) Alnylam will have the sole and exclusive right to select counsel for any suit referred to in subsection 5.3(b) above initiated by it and will pay all expenses of the suit, including without limitation attorneys' fees and court costs.

5.4 Competitive Infringement of Category 1 Patents.

(a) Each Party will promptly report in writing to the other Party during the Term any known or suspected infringement by a Third Party of any of the Category 1 Patents of which such Party becomes aware. If any such infringement relates to the development, making, using, selling, offering for sale or importing of a product that is directed against an Alnylam Exclusive Target ("Competitive Infringement"), then Alnylam will have the first right to initiate an infringement or other appropriate suit in the Territory with respect to such Competitive Infringement; provided, that if Alnylam fails to initiate a suit or take other appropriate action with respect to such Competitive Infringement within [**] days after becoming aware of the basis for such suit or action, then Tekmira may, in its discretion, provide Alnylam with written notice of Tekmira's intent to initiate a suit or take other appropriate action with respect to such Competitive Infringement. If Tekmira provides such notice and Alnylam fails to initiate a suit or take such other appropriate action within [**] days after receipt of such notice from Tekmira, then Tekmira shall have the right to initiate a suit or take other appropriate action that it believes is reasonably required to protect its interests with respect to such Competitive Infringement.

(b) The Party bringing the enforcement action with respect to such Competitive Infringement shall have the right to defend against any claim arising during such action asserting that the Category 1 Patent that is subject of such Competitive Infringement is invalid or unenforceable.

(c) Regardless of which Party brings such the enforcement action with respect to such Competitive Infringement, the Party not bringing the enforcement action shall (i) provide all reasonable assistance to the Party bringing the action, at the expense of the Party bringing the action, and (ii) have the right to join and participate in such action at its own expense with its own counsel and to share equally all expenses of such suit if it so elects. If required under applicable law in order for the initiating Party to initiate and/or maintain such suit, or if the initiating Party is unable to initiate or prosecute such suit solely in its own name or it is otherwise advisable to obtain an effective legal remedy, in each case, the other Party shall, at the expense of the initiating Party, join as a party to the suit and will execute all documents necessary for the initiating Party to initiate litigation to prosecute and maintain such action.

(d) Any damages or other recovery, whether by settlement or otherwise, from an action under this Section 5.4 to enforce the Category 1 Patent against Competitive Infringement shall first be applied *pro rata* to reimburse the Parties for the costs and expenses of litigation in such action, and [**] percent ([**]%) of any remaining amount shall be paid to or retained by the Party conducting the litigation and [**] percent ([**]%) of such remaining amount shall be paid to or retained by the other Party.

5.5 Third Party Infringement of Tekmira's Patents.

(a) Each Party will promptly report in writing to the other Party during the Term any known or suspected infringement by a Third Party of any Patents within the Tekmira Combined Licensed Technology of which such Party becomes aware, as such infringement relates to the Research, Development or Commercialization of Products directed at any Alnylam Target, or any Alnylam Product, and will provide the other Party with all available evidence supporting such infringement.

(b) Tekmira will have the sole and exclusive right to initiate an infringement or other appropriate suit in the Territory with respect to infringements or suspected infringements of any of the Patents within the Tekmira Combined Licensed Technology, and of any of the Category 1 Patents that does not constitute Competitive Infringement and to any and all recoveries obtained in connection therewith.

(c) Tekmira will have the sole and exclusive right to select counsel for any suit referred to in subsection 5.5(b) above initiated by it and will pay all expenses of the suit, including without limitation attorneys' fees and court costs.

5.6 Patent Certification. To the extent required by law or permitted by law, the Parties shall use reasonable efforts to maintain with the applicable regulatory authorities during the Term correct and complete listings of applicable Patents for Alnylam Products or Tekmira Products, as the case may be, being Commercialized, including but not limited to all so-called "Orange Book" listings required under the Hatch-Waxman Act.

ARTICLE VI- CONFIDENTIAL INFORMATION AND PUBLICITY

6.1 Non-Disclosure of Confidential Information. Each Party agrees that all Confidential Information of a Party that is disclosed by a Party to the other Party (a) will not be used by the receiving Party except in connection with the activities contemplated by this Agreement, (b) will be maintained in confidence by the receiving Party, and (c) will not be disclosed by the receiving Party to any Third Party without the prior written consent of the disclosing Party. Notwithstanding the foregoing, the receiving Party will be entitled to use and disclose Confidential Information of the disclosing Party that (i) was known by the receiving Party or its Affiliates prior to its date of disclosure by the disclosing Party to the receiving Party as demonstrated by legally admissible evidence available to the receiving Party, (ii) either before or after the date of the disclosure such Confidential Information is lawfully disclosed to the receiving Party or its Affiliates by sources other than the disclosing Party, (iii) either before or after the date of the disclosure by the disclosing Party or its Affiliates to the receiving Party such Confidential Information becomes published or otherwise part of the public domain through no fault, act or omission on the part of the receiving Party or its Affiliates, (iv) is independently developed by or for the receiving Party or its Affiliates without reference to or in reliance upon the Confidential Information as demonstrated by legally admissible evidence available to the receiving Party or its Affiliates, (v) is reasonably necessary to conduct clinical trials or to obtain regulatory approval of Products, or for the prosecution and maintenance of Patents, and such Patents shall include without limitation claims to the nucleic acid component of the Products, the Products as formulated with an LNP including excipients, as well as methods of use and manufacture of the foregoing, along with any other claims that are usual and customary to obtain maximum protection for a pharmaceutical, (vi) is reasonably required in order for a Party to obtain financing or conduct discussions with existing or potential Development and/or Commercialization partners so long as such Third Party recipients are bound by an obligation of confidentiality, or (vii) in the reasonable judgment of the receiving Party is required to be disclosed by the receiving Party to comply with applicable laws or regulations or legal process, including without limitation by the rules or regulations of the United States Securities and Exchange Commission or similar regulatory agency in a country other than the United States or

of any stock exchange or NASDAQ, provided that the receiving Party provides prior written notice of such disclosure to the disclosing Party and takes reasonable and lawful actions to avoid or minimize the extent of such disclosure, or (viii) solely with respect to Confidential Information comprising Alnylam Know-How, Tekmira Know-How or Protiva Know-How, is otherwise reasonably necessary to disclose in connection with the Research, Development or Commercialization of Products hereunder.

Alnylam and its Affiliates shall not provide the Tekmira Manufacturing Documents or copies thereof to any Third Party, and shall not reproduce such Tekmira Manufacturing Documents in any patent application, publication or other public disclosure; provided, however, that Alnylam and its Affiliates shall be permitted to provide such Tekmira Manufacturing Documents to (1) on a need-to-know basis, Third Party contract manufacturers and other Permitted Contractors that are engaged to manufacture Alnylam Products or to provide services in connection with Development, Manufacturing or regulatory matters for Alnylam Products and/or (2) Sublicensees (who shall also be permitted to provide such Tekmira Manufacturing Documents on a need-to-know basis to Third Party contract manufacturers and other Permitted Contractors that are engaged to manufacture Alnylam Products or to provide services in connection with Development, Manufacturing or regulatory matters for Alnylam Products), in each of the foregoing clauses (1) or (2), that are subject to binding confidentiality agreements containing reasonably customary terms and conditions and, in the case of Third Party contract manufacturers and other Permitted Contractors, restricting such Third Parties from providing the Tekmira Manufacturing Documents to further Third Parties other than in accordance with clause (3) below, and/or (3) regulatory authorities to the extent reasonably necessary to obtain Regulatory Approval for, or comply with regulatory requirements applicable to the Development or Commercialization of, any Alnylam Product.

Notwithstanding anything to the contrary in this Agreement, the confidentiality and non-use obligations under this Agreement and the restrictions set forth in the immediately preceding paragraph shall not apply to Confidential Information consisting of Alnylam Know-How, Tekmira Know-How or Protiva Know-How, including such Confidential Information comprised by the Tekmira Manufacturing Documents, that is mentally retained in the unaided memories of the receiving Party's and its Affiliates' employees, consultants and advisors.

For the avoidance of doubt, information received by a Party solely as a result of the litigation settled pursuant to the Settlement Agreement shall not be governed by this Agreement and therefore shall not be subject to the exceptions set forth in the immediately preceding paragraphs permitting the use and disclosure of Confidential Information hereunder (i.e., nothing in this Agreement shall lessen any restrictions on the use and disclosure of such information imposed in such litigation proceedings).

If a Party is required by judicial or administrative process to disclose Confidential Information that is subject to the non-disclosure provisions of this Section 6.1, such Party shall promptly inform the other Party of the disclosure that is being sought in order to provide the other Party an opportunity to challenge or limit the disclosure obligations. Confidential Information that is disclosed by judicial or administrative process shall remain otherwise subject to the confidentiality and non-use provisions of this Section 6.1, and the Party disclosing Confidential

Information pursuant to law or court order shall take all steps reasonably practical, including without limitation seeking an order of confidentiality, to ensure the continued confidential treatment of such Confidential Information. In addition to the foregoing restrictions on public disclosure, if either Party concludes that a copy of this Agreement must be filed with the United States Securities and Exchange Commission or similar regulatory agency in a country other than the United States, such Party shall seek the maximum confidential treatment available under applicable law, provide the other Party with a copy of this Agreement showing any sections as to which the Party proposes to request confidential treatment, provide the other Party with an opportunity to comment on any such proposal and to suggest additional portions of this Agreement for confidential treatment, and take such Party's reasonable comments into consideration before filing this Agreement.

6.2 Limitation on Disclosures. Each Party agrees that it will provide Confidential Information received from the other Party solely to its employees, consultants and advisors, and the employees, consultants and advisors of its or its Affiliates or existing or potential Sublicensees, as applicable, who have a legitimate business need to know and an obligation to maintain in confidence the Confidential Information of the disclosing Party. The receiving Party is liable for any breach of the non-disclosure obligation of, as applicable, (a) its and its Affiliates' employees, consultants and advisors, (b) existing or potential Sublicensees and (c) the employees, consultants and advisors of any existing or potential Sublicensees.

6.3 Publicity.

(a) No disclosure of the existence of, or the terms of, this Agreement may be made by either Party or its Affiliates, and no Party or its Affiliates shall use the name, trademark, trade name or logo of the other Party or its employees in any publicity, news release or disclosure relating to this Agreement or its subject matter, without the prior express written permission of the other Party, except as may be required by law or as set forth in this Section 6.3. Either Party may issue press releases or otherwise make public statements or disclosures (such as in annual reports to stockholders or filings with the Securities and Exchange Commission) as it determines, based on advice of counsel, are reasonably necessary to comply with applicable laws and regulations. In addition, following any press release(s) announcing this Agreement or any other public disclosure by the Parties, either Party shall be free to disclose, without the other Party's prior written consent, the existence of this Agreement, the identity of the other Party and those terms of the Agreement which have already been publicly disclosed in accordance herewith.

Any reference made by Alnylam in a press release to LNP technology shall include the following statement:

"About LNP Technology

Alnylam has licenses to Tekmira LNP intellectual property for use in RNAi therapeutic products."

Any reference made by Tekmira in a press release to siRNA programs shall include the following statement:

"About Alnylam RNAi Technology

Tekmira has licenses to Alnylam RNAi intellectual property for certain RNAi programs."

ARTICLE VII- INDEMNIFICATION AND INSURANCE

7.1 Tekmira Indemnification. Tekmira agrees to indemnify and hold harmless Alnylam and its Affiliates, and their respective agents, directors, officers and employees and their respective successors and permitted assigns (the "Alnylam Indemnitees") from and against any and all losses, costs, damages, fees or expenses ("Losses") incurred by an Alnylam Indemnitee arising out of or in connection with any claim, suit, demand, investigation or proceeding brought by a Third Party based on (a) any claim made against Alnylam by Third Parties regardless of the form or forum in which any such claim is made alleging (i) infringement or misappropriation of Third Party intellectual property, or (ii) personal injury, or death occurring to any person claimed to result, directly or indirectly, from the possession, use or consumption of, or treatment with, any Tekmira Product Covered by an Alnylam Patent, whether claimed by reason of breach of warranty, negligence or product defect, and (b) any breach of any representation, warranty or covenant of Tekmira in this Agreement.

The above indemnification shall not apply to the extent that any Losses are due to a breach of any of Alnylam's representations, warranties, covenants and/or obligations under this Agreement.

7.2 Alnylam Indemnification. Alnylam agrees to indemnify and hold harmless Tekmira, its Affiliates, and their respective agents, directors, officers and employees and their respective successors and permitted assigns (the "Tekmira Indemnitees") from and against any and all Losses incurred by a Tekmira Indemnitee arising out of or in connection with any claim, suit, demand, investigation or proceeding brought by a Third Party based on (a) any claim made against Tekmira by Third Parties regardless of the form or forum in which any such claim is made alleging (i) infringement or misappropriation of Third Party intellectual property, or (ii) personal injury, or death occurring to any person claimed to result, directly or indirectly, from the possession, use or consumption of, or treatment with, any Alnylam Product Covered by a Tekmira Patent, whether claimed by reason of breach of warranty, negligence or product defect, and (b) any breach of any representation, warranty or covenant of Alnylam in this Agreement.

The above indemnification shall not apply to the extent that any Losses are due to a breach of any of Tekmira's representations, warranties, covenants and/or obligations under this Agreement.

7.3 Tender of Defense; Counsel. The obligation to indemnify pursuant to this Article shall be contingent upon timely notification by the indemnitee to the indemnitor of any claims, suits or service of process; the tender by the indemnitee to the indemnitor of full control over the conduct and disposition of any claim, demand or suit; and reasonable cooperation by the

indemnitee in the defense of the claim, demand or suit. No indemnitor will be bound by or liable with respect to any settlement or admission entered or made by any indemnitee without the prior written consent of the indemnitor. The indemnitee will have the right to retain its own counsel to participate in its defense in any proceeding hereunder. The indemnitee shall pay for its own counsel except to the extent it is determined that (a) one or more legal defenses may be available to it which are different from or additional to those available to the indemnitor, or (b) representation of both Parties by the same counsel would be inappropriate due to actual or potential differing interests between them. In any such case and to such extent, the indemnitor shall be responsible to pay for the reasonable costs and expenses of one separate counsel retained to participate in the defense of the indemnitee, provided that such expenses are otherwise among those covered by the indemnitor's indemnity obligations under this Article VII. Notwithstanding the foregoing, if the indemnitor reasonably believes that any of the exceptions to its obligation of indemnification of the indemnitee set forth in Sections 7.1 or 7.2 may apply, the indemnitor shall promptly notify the indemnitee, which shall then have the right to be represented in any such action or proceeding by separate counsel at the indemnitee's expense; provided, that the indemnitor shall be responsible for payment of such expenses if the indemnitee is ultimately determined to be entitled to indemnification from the indemnitor.

7.4 Tekmira Insurance. With respect to its activities under this Agreement, Tekmira will secure and maintain in full force and effect throughout the term of the licenses set out in Section 2.1 (and for at least [**] years thereafter for claims-made coverage), the following types and amounts of insurance coverage with carriers having a minimum AM Best rating of A, with per claim deductibles that do not exceed [**] U.S. dollars ($[**]):

Comprehensive General Liability and Personal Injury, including coverage for contractual liability assumed by Tekmira and coverage for Tekmira independent contractor(s), with limits of at least [**] U.S. dollars ($[**]) per occurrence and a general aggregate limit of t[**] U.S. dollars ($[**]).

Prior to, at, and following the dosing of the first patient in a Phase I Clinical Trial of any Tekmira Product by Tekmira, its Affiliates or Sublicensees, Umbrella Liability, exclusive of the coverage provided by the policies listed above, with a limit of at least [**] U.S. dollars ($[**]).

Prior to, at, and following the First Commercial Sale of any Tekmira Product by Tekmira, its Affiliates or Sublicensees, Products/Clinical/Professional Liability, exclusive of the coverage provided by the Comprehensive General Liability policy, with limits of at least [**] U.S. dollars ($[**]) per occurrence and an aggregate limit of at least [**] dollars ($[**]), with Alnylam to be named as an additional insured party with respect to each Tekmira Product under such coverage.

7.5 Alnylam Insurance. With respect to its activities under this Agreement, Alnylam will secure and maintain in full force and effect throughout the term of the licenses set out in Sections 2.2(a) and 2.2(b) (and for at least [**] years thereafter for claims-made coverage), the following types and amounts of insurance coverage with carriers having a minimum AM Best rating of A, with per claim deductibles that do not exceed [**] U.S. dollars ($[**]):

Comprehensive General Liability and Personal Injury, including coverage for contractual liability assumed by Alnylam and coverage for Alnylam independent contractor(s), with limits of at least [**] U.S. dollars ($[**]) per occurrence and a general aggregate limit of [**] U.S. dollars ($[**]).

Prior to, at, and following the dosing of the first patient in a Phase I Clinical Trial of any Alnylam Product by Alnylam, its Affiliates or Sublicensees, Umbrella Liability, exclusive of the coverage provided by the policies listed above, with a limit of at least [**] U.S. dollars ($[**]).

Prior to, at, and following the First Commercial Sale of any Alnylam Product by Alnylam, its Affiliates or Sublicensees, Products/Clinical Liability, exclusive of the coverage provided by the Comprehensive General Liability policy, with limits of at least [**] U.S. dollars ($[**]) per occurrence and an aggregate limit of at least [**] U.S. dollars ($[**]), with Tekmira to be named as an additional insured party with respect to each Alnylam Product under such coverage.

ARTICLE VIII- EXPORT

8.1 General. The Parties acknowledge that the exportation from the United States of materials, products and related technical data (and the re-export from elsewhere of United States origin items) may be subject to compliance with United States export laws, including without limitation the United States Bureau of Export Administration's Export Administration Regulations, the Act and regulations of the FDA issued thereunder, and the United States Department of State's International Traffic and Arms Regulations which restrict export, re-export, and release of materials, products and their related technical data, and the direct products of such technical data. The Parties agree, under this Agreement, to comply with all applicable exports laws and to commit no act that, directly or indirectly, would violate any United States law, regulation, or treaty, or any other international treaty or agreement, relating to the export, re-export, or release of any materials, products or their related technical data to which the United States adheres or with which the United States complies.

8.2 Delays. The Parties acknowledge that they cannot be responsible for any delays attributable to export controls which are beyond the reasonable control of either Party.

8.3 Assistance. The Parties agree to provide reasonable assistance to one another in connection with each Party's efforts to fulfill its obligations under this Article VIII.

ARTICLE IX- TERM AND TERMINATION

9.1 Term; Expiration. The term of this Agreement shall begin on the Effective Date and, unless terminated earlier as provided herein, the licenses granted under Sections 2.1(a), 2.1(b), 2.2(a), 2.2(b) and 2.2(c) of this Agreement will become fully paid-up, perpetual, non-exclusive and irrevocable at the end of the period set forth in Section 4.7, as applicable to each of such licenses. The term of this Agreement shall expire upon the expiration of the last-to-expire Royalty Term.

9.2 Material Breach.

(a) Alnylam, as the licensor under Section 2.1, will have the right to terminate the licenses granted thereunder, upon written notice to Tekmira, on a Tekmira Product-by-Tekmira Product basis in the event Tekmira materially breaches its obligations under this Agreement related to the licenses granted under Section 2.1 with respect to a particular Tekmira Product(s), or such licenses in their entirety if such breach is not specific to particular Tekmira Product(s), and Tekmira does not remedy such breach within ninety (90) days after receipt of written notice from Alnylam specifically identifying the breach and stating that Alnylam intends to terminate such licenses if Tekmira fails to remedy the breach within the ninety (90)-day time period; provided, however, that if Tekmira disputes in good faith that the claimed breach exists, such 90-day period will not start to run until such dispute has been resolved or can no longer be maintained in good faith.

(b) Tekmira, as the licensor under Section 2.2, will have the right to terminate the licenses granted thereunder, upon written notice to Alnylam, on an Alnylam Product-by-Alnylam Product or technology-by-technology basis in the event Alnylam materially breaches its obligations under this Agreement related to the licenses granted under Section 2.2 with respect to a particular Alnylam Product(s) or technology(-ies), or such licenses in their entirety if such breach is not specific to particular Alnylam Product(s) or technology(-ies), and does not remedy such breach within ninety (90) days after receipt of written notice from Tekmira specifically identifying the breach and stating that Tekmira intends to terminate such licenses if Alnylam fails to remedy the breach within the ninety (90)-day time period; provided, however, that if Alnylam disputes in good faith that the claimed breach exists, such 90-day period will not start to run until such dispute has been resolved or can no longer be maintained in good faith.

9.3 Challenges of Alnylam's Patents. In the event that Tekmira or any of its Affiliates shall (a) commence or participate in any action or proceeding (including, without limitation, any patent opposition or re-examination proceeding), or otherwise assert in writing any claim, challenging or denying the validity of any of the Alnylam Patents or any claim thereof or (b) actively assist any other Person in bringing or prosecuting any action or proceeding (including, without limitation, any patent opposition or re-examination proceeding) challenging or denying the validity of the Alnylam Patents or any claim thereof, Alnylam will have the right to give notice to Tekmira (which notice must be given, if at all, within sixty (60) days after Alnylam first learns of the foregoing) that the licenses granted by Alnylam to such Patent will terminate in thirty (30) days following such notice, and, unless Tekmira withdraws or causes to be withdrawn all such challenge(s) within such thirty-day period, such licenses will so terminate.

9.4 Challenges of Tekmira Patents. In the event that Alnylam or any of its Affiliates shall (a) commence or participate in any action or proceeding (including, without limitation, any patent opposition or re-examination proceeding), or otherwise assert in writing any claim, challenging or denying the validity of any of the Category 1 Patents or Patents within the Tekmira Combined Licensed Technology, or any claim thereof or (b) actively assist any other Person in bringing or prosecuting any action or proceeding (including, without limitation, any patent opposition or re-examination proceeding) challenging or denying the validity of any of the Category 1 Patents or Patents within the Tekmira Combined Licensed Technology, or any claim thereof, Tekmira will have the right to give notice to Alnylam (which notice must be given, if at all, within sixty (60) days after Tekmira first learns of the foregoing) that Alnylam's license

under such Patent will terminate in thirty (30) days following such notice, and, unless Alnylam withdraws or causes to be withdrawn all such challenge(s) within such thirty-day period, such licenses will so terminate.

9.5 Consequences of Termination; Survival.

(a) In the event of termination by Alnylam under Section 9.2(a) above, all licenses and rights granted by Alnylam to Tekmira under Section 2.1 of this Agreement will terminate with respect to the particular Tekmira Product(s), or in their entirety, as provided in Section 9.2(a); provided, however, that to the extent such licenses and rights are required in respect of clinical trials that are ongoing and cannot reasonably be terminated promptly due to health or safety reasons or the requirements of applicable law, such licenses and rights will continue in effect until such clinical trials are properly terminated; provided, further, that any license that has become fully paid-up and perpetual pursuant to Section 9.1 shall survive.

(b) In the event of termination by Tekmira under Section 9.2(b) above, all licenses and rights granted by Tekmira to Alnylam under Section 2.2 of this Agreement will terminate with respect to the particular Alnylam Product(s) and/or technology(-ies), or in their entirety, as provided in Section 9.2(b); provided, however, that to the extent such licenses and rights are required in respect of clinical trials that are ongoing and cannot reasonably be terminated promptly due to health or safety reasons or the requirements of applicable law, such licenses and rights will continue in effect until such clinical trials are properly terminated; provided, further, that any license that has become fully paid-up and perpetual pursuant to Section 9.1 shall survive.

(c) Expiration or termination of this Agreement shall not relieve the Parties of any obligation accruing prior to such expiration or termination. Any expiration or termination of this Agreement shall be without prejudice to the rights of either Party against the other accrued or accruing under this Agreement prior to expiration or termination, including without limitation the obligation to pay royalties for Products sold prior to such expiration or termination. The provisions of Sections 6.1, 6.2 and 6.3(a) shall survive the expiration or termination of this Agreement for a period of five (5) years. In addition, the provisions of Sections 2.2(c) (to the extent the license in such section extends outside of Alnylam Products in the Alnylam Field), 2.2(d), 2.4, 2.6, 2.7, 4.7, 4.11, 4.12, 4.13, 4.14, 4.15, 5.1(d), 5.4, Article VII, 9.1, 9.5, 9.6, 10.1(d), 10.2, 10.4, 10.6, 10.8 and 10.16, and any license that has become fully paid-up and perpetual pursuant to Section 9.1, shall survive any expiration or termination of this Agreement.

9.6 Licenses upon Termination.

(a) Upon any termination of this Agreement, Alnylam shall enter into an agreement containing substantially the same provisions as this Agreement with any Sublicensees of Tekmira existing at the time of such termination, covering the Tekmira Products that had been licensed to such Sublicensee by Tekmira in compliance with this Agreement, provided that at the time of any termination of this Agreement, such Sublicensees are in full compliance with the terms and conditions of the sublicense agreement. Alnylam acknowledges that such Sublicensees of Tekmira that are then in full compliance with the terms and conditions of their

respective sublicense agreement are third party beneficiaries of this Agreement, including this Section 9.6(a).

(b) Upon any termination of this Agreement, Tekmira shall enter into an agreement containing substantially the same provisions as this Agreement with any Sublicensees of Alnylam existing at the time of such termination, covering the Alnylam Products that had been licensed to such Sublicensee by Alnylam in compliance with this Agreement, provided that at the time of any termination of this Agreement, such Sublicensees are in full compliance with the terms and conditions of the sublicense agreement. Tekmira acknowledges that such Sublicensees of Alnylam that are then in full compliance with the terms and conditions of their respective sublicense agreement are third party beneficiaries of this Agreement, including this Section 9.6(b).

ARTICLE X- MISCELLANEOUS

10.1 Representations and Warranties.

(a) Mutual Representations and Warranties by Tekmira and Alnylam.

(i) Each Party hereby represents and warrants to the other Party as of the Effective Date:

(a) It is duly organized and validly existing under the laws of the jurisdiction of its incorporation or formation, and has all necessary power and authority to conduct its business in the manner in which it is currently being conducted, to own and use its assets in the manner in which its assets are currently owned and used, and to enter into and perform its obligations under this Agreement.

(b) The execution, delivery and performance of this Agreement has been duly authorized by all necessary action on the part of such Party and its Board of Directors and no consent, approval, order or authorization of, or registration, declaration or filing with any Third Party or governmental authority is necessary for the execution, delivery or performance of this Agreement.

(c) This Agreement constitutes the legal, valid and binding obligation of such Party, enforceable against it in accordance with its terms, subject to (A) laws of general application relating to bankruptcy, insolvency and the relief of debtors, and (B) rules of law governing specific performance, injunctive relief and other equitable remedies.

(d) It has never approved or commenced any proceeding, or made any election contemplating, the winding up or cessation of its business or affairs or the assignment of material assets for the benefit of creditors. To such Party's knowledge, no such proceeding is pending or threatened.

(ii) Each Party acknowledges and agrees that the other Party has not made any representation or warranty that it has or can provide all the rights that are necessary or useful to Research, Develop or Commercialize a Product.

(iii) Each Party represents and warrants to the other Party that as of the Effective Date it has the right to grant to such other Party, its Affiliates and Sublicensees the licenses granted hereunder and has not granted any conflicting rights to any other Person. Each Party shall maintain any applicable in-licenses in effect and shall not amend any such in-licenses in a manner that is detrimental to the rights of the other Party under this Agreement without the prior written consent of such other Party.

(b) Alnylam Representations and Warranties. Alnylam hereby represents and warrants to Tekmira that:

(i) to Alnylam's knowledge, the conception, development and reduction to practice of the Alnylam Licensed Technology licensed to Tekmira under this Agreement did not constitute or involve the misappropriation of trade secrets or other rights or property of any Person;

(ii) it has not assigned, transferred, conveyed or otherwise encumbered its right, title and interest in the Alnylam Licensed Technology in a manner that conflicts with any rights granted to Tekmira hereunder.

(c) Tekmira Representations and Warranties. Tekmira hereby represents and warrants to Tekmira that:

(i) to Tekmira's knowledge, the conception, development and reduction to practice of the Tekmira Combined Licensed Technology licensed to Alnylam under this Agreement did not constitute or involve the misappropriation of trade secrets or other rights or property of any Person; and

(ii) it has not assigned, transferred, conveyed or otherwise encumbered its right, title and interest in the Tekmira Combined Licensed Technology in a manner that conflicts with any rights granted to Alnylam hereunder.

(d) Warranty Disclaimer. EXCEPT AS OTHERWISE EXPRESSLY PROVIDED IN THIS AGREEMENT, NEITHER PARTY MAKES ANY REPRESENTATION OR EXTENDS ANY WARRANTY OR CONDITIONS OF ANY KIND, EITHER EXPRESS OR IMPLIED, TO THE OTHER PARTY WITH RESPECT TO ANY INTELLECTUAL PROPERTY, PRODUCTS, GOODS, RIGHTS OR OTHER SUBJECT MATTER OF THIS AGREEMENT AND HEREBY DISCLAIMS ALL IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR VALIDITY OF PATENT RIGHTS WITH RESPECT TO ANY AND ALL OF THE FOREGOING. EACH PARTY HEREBY DISCLAIMS ANY REPRESENTATION OR WARRANTY THAT THE DEVELOPMENT, MANUFACTURE OR COMMERCIALIZATION OF ANY PRODUCT PURSUANT TO THIS AGREEMENT WILL BE SUCCESSFUL OR THAT ANY PARTICULAR SALES LEVEL WITH RESPECT TO ANY SUCH PRODUCT WILL BE ACHIEVED.

10.2 Dispute Resolution; Arbitration Procedures. The Parties agree that any disputes that arise under this Agreement between them during the period starting on the Effective Date and ending on the third anniversary of the Effective Date, including without limitation, claims relating to the enforcement of this Agreement, shall be resolved by binding arbitration conducted in accordance with the Commercial Arbitration Rules and Supplementary Procedures for Large Complex Disputes of the American Arbitration Association ("AAA"). The arbitration shall be conducted by a panel of three persons experienced in large commercial disputes who are independent of the arbitrating Parties and neutral with respect to the dispute presented for arbitration. Within [**] days after initiation of arbitration, each arbitrating Party shall select one person to act as an arbitrator and the Party-selected arbitrators shall select an additional arbitrator within [**] days of their appointment. If the arbitrators selected by the Parties are unable or fail to agree on the third arbitrator, the additional arbitrator shall be appointed by the AAA. The place of the arbitration shall be in Chicago, Illinois, USA, and all proceedings and communications shall be in English. Except to the extent necessary to confirm an award or as may be required by law, neither a Party nor an arbitrator may disclose the existence, content, or results of an arbitration without the prior written consent of both Parties.

10.3 Force Majeure. No failure or omission by the Parties in the performance of any obligation of this Agreement will be deemed a breach of this Agreement or create any liability if the same will arise from any cause or causes beyond the control of the Parties, including, but not limited to, the following: acts of God; acts or omissions of any government; any rules, regulations or orders issued by any governmental authority or by any officer, department, agency or instrumentality thereof; fire; flood; storm; earthquake; accident; war; rebellion; insurrection; riot; and invasion. The affected Party shall notify the other Party of such force majeure circumstances as soon as reasonably practical, and shall promptly undertake all reasonable efforts necessary to cure such force majeure circumstances.

10.4 Consequential Damages. NEITHER PARTY (INCLUDING ITS AFFILIATES AND SUBLICENSEES) SHALL BE LIABLE UNDER THIS AGREEMENT FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR FOR LOSS OF PROFIT OR LOST REVENUE, EVEN IF SUCH PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. NOTWITHSTANDING THE FOREGOING, NOTHING IN THIS SECTION 10.4 IS INTENDED TO OR SHALL LIMIT OR RESTRICT THE INDEMNIFICATION RIGHTS OF A PARTY OR DAMAGES AVAILABLE FOR A PARTY'S BREACH OF CONFIDENTIALITY OBLIGATIONS IN ARTICLE VI.

10.5 Assignment.

(a) This Agreement, and any of its rights and obligations, may not be assigned or otherwise transferred by either Party without the prior written consent of the other Party, which consent shall not be unreasonably withheld, delayed or conditioned; provided, however, that either Party may assign this entire Agreement, without the consent of the other Party, in connection with such Party's merger, consolidation or transfer or sale of all or substantially all of the assets of such Party; and provided further that the successor, surviving entity, purchaser of assets, or transferee, as applicable, expressly assumes in writing such Party's obligations under this Agreement, if any.

(b) Any purported transfer or assignment in contravention of this Section 10.5 shall, at the option of the non-assigning Party, be null and void and of no effect.

(c) This Agreement shall be binding upon and inure to the benefit of the Parties and their permitted successors and assigns.

10.6 Notices.

Notices to Alnylam will be addressed to:

Alnylam Pharmaceuticals, Inc.
300 Third Street
Cambridge, Massachusetts 02142
U.S.A.
Attention: Senior Vice President, Chief Business Officer
Facsimile No.: (617) 812-0353

With copy to:

WilmerHale LLP
60 State Street
Boston, Massachusetts 02109
Attention: Steven D. Singer, Esq.
Steven D. Barrett, Esq.
Facsimile No.: (617) 526-5000

Notices to Tekmira will be addressed to:

Tekmira Pharmaceuticals Corporation
100-8900 Glenlyon Parkway
Burnaby, B.C.
Canada V5J 5J8
Attention: President & CEO
Facsimile No.: (604) 630-5103

With copy to:

Orrick, Herrington & Sutcliffe LLP
1000 Marsh Road
Menlo Park, CA 94025-1015
Attention: Elizabeth A. Howard
R. King Milling
Facsimile No.: (650) 614-7401

Either Party may change its address by giving notice to the other Party in the manner provided in this Section 10.6. Any notice required or provided for by the terms of this Agreement will be in

writing and will be (a) sent by certified mail, return receipt requested, postage prepaid, (b) sent via a reputable international express courier service, or (c) sent by facsimile transmission, with a copy by regular mail. The effective date of the notice will be the actual date of receipt by the receiving Party.

10.7 Independent Contractors. It is understood and agreed that the relationship between the Parties is that of independent contractors and that nothing in this Agreement will be construed as authorization for either Party to act as the agent for the other Party.

10.8 Governing Law; Jurisdiction. This Agreement will be governed and interpreted in accordance with the substantive laws of the State of Delaware, U.S.A., notwithstanding the provisions governing conflict of laws under such law of the State of Delaware to the contrary, provided that (a) matters of intellectual property law, if any, will be determined in accordance with the national intellectual property laws relevant to the intellectual property in question, and (b) the application of the 1980 United Nations Convention on Contracts for the International Sale of Goods is expressly excluded from this Agreement.

10.9 Severability. In the event that any provision of this Agreement is held by a court of competent jurisdiction to be unenforceable because it is invalid or in conflict with any law of the relevant jurisdiction, the validity of the remaining provisions will not be affected and the rights and obligations of the Parties will be construed and enforced as if the Agreement did not contain the particular provisions held to be unenforceable, provided that the Parties will negotiate in good faith a modification of this Agreement with a view to revising this Agreement in a manner which reflects, as closely as is reasonably practicable, the commercial terms of this Agreement as originally signed.

10.10 No Implied Waivers. The waiver by either Party of a breach or default of any provision of this Agreement by the other Party will not be construed as a waiver of any succeeding breach of the same or any other provision, nor will any delay or omission on the part of either Party to exercise or avail itself of any right, power or privilege that it has or may have hereunder operate as a waiver of any right, power or privilege by such Party.

10.11 Headings. The headings of articles and sections contained this Agreement are intended solely for convenience and ease of reference and do not constitute any part of this Agreement, or have any effect on its interpretation or construction.

10.12 Entire Agreement. This Agreement constitutes the entire agreement between the Parties with respect to its subject matter and supersedes all previous written or oral representations, agreements and understandings between the Parties including, without limitation, the Prior Cross-License Agreements and the Manufacturing Agreements, but excluding the Settlement Agreement, the Supplemental Agreement (subject to Section 2.4) and the UBC Sublicense. The Parties specifically agree that the corresponding provisions of this Agreement shall supersede in their entirety any surviving provisions of the Prior Cross-License Agreements. This Agreement (including the attachments hereto) may be amended only by a writing signed by both Parties.

10.13 Waiver of Rule of Construction. Each Party has had the opportunity to consult with counsel in connection with the review, drafting and negotiation of this Agreement. Accordingly, the rule of construction that any ambiguity in this Agreement shall be construed against the drafting Party shall not apply.

10.14 No Third Party Beneficiaries. Except as expressly contemplated herein, no Third Party, including any employee of any Party to this Agreement, shall have or acquire any rights by reason of this Agreement.

10.15 Further Assurances. Each Party will provide such further documents or instruments required by the other Party as may be reasonably necessary or desirable to give effect to the purpose of this Agreement and carry out its provisions.

10.16 Performance by Affiliates. Either Party may use one or more of its Affiliates to perform its obligations and duties hereunder and Affiliates of a Party are expressly granted certain rights herein; provided that each such Affiliate shall be bound by the corresponding obligations of such Party and the relevant Party shall remain liable hereunder for the prompt payment and performance of all their respective obligations hereunder.

10.17 Counterparts. This Agreement may be executed in any number of counterparts, each of which will be deemed an original, and all of which together will constitute one and the same instrument.

[*Signature Page Follows*]

IN WITNESS WHEREOF, Alnylam, Tekmira and Protiva have set their hands to this Cross-License Agreement as of the date first written above.

ALNYLAM PHARMACEUTICALS, INC.

By: /s/ Barry Greene
Name: Barry Greene
Title: President and Chief Operating Officer

TEKMIRA PHARMACEUTICALS CORPORATION

By: /s/ Mark J. Murray
Name: Mark J. Murray
Title: President & CEO

PROTIVA BIOTHERAPEUTICS INC.
solely with respect to Section 10.12

By: /s/ Mark J. Murray
Name: Mark J. Murray
Title: President & CEO

EXHIBIT A - IP MANAGEMENT TERMS

Management of Category 1, 2, and 3 Patents

1. The Category 1 Patents shall be assigned to Tekmira pursuant to Section 5.1(a) of this Agreement. Within [**] days of the Effective Date, representative(s) of each Party shall meet in the offices of Blank Rome in NY, NY to coordinate the transition of prosecution control from Alnylam to Tekmira. Within [**] business days of the Effective Date, Alnylam will determine which priority applications, in whole or in part, within the [**] family will be assigned to Tekmira and shall record such assignments with the U.S. Patent and Trademark Office. For clarity, all priority applications, in whole or in part, to which [**] family members that have been assigned to Tekmira are entitled, or are necessary to effect a valid priority claim shall be assigned to Tekmira according to the procedure set forth above.

2. The Category 2 Patents and the Category 3 Patents shall be owned by Alnylam. If Tekmira obtains any ownership interest in any Category 2 Patents or any Category 3 Patents as a result of any inventorship determination pursuant to this Agreement, Tekmira shall assign such interest to Alnylam as set forth in Section 5.1(b) of this Agreement.

3. If it is determined that a novel lipid, or novel lipid formulation is disclosed for the first time in a Category 2 Patent application or a Category 3 Patent application, then a divisional or continuation will be filed to isolate this subject matter. The division or continuation will be assigned to Tekmira, and for the purposes of this Agreement will be treated as Category 1 IP.

4. Prosecution and Maintenance of Category 1 Patents.

a. Within [**] days following the Effective Date, each Party shall provide to the other Party the name of the person responsible for prosecution and maintenance of Category 1 Patents within such Party's company.

b. The Parties agree that current outside US counsel utilized by Alnylam prior to the Effective Date shall continue to handle US prosecution and coordinate rest of world prosecution of Category 1 Patents for a period of at least [**] month from the Effective Date. For [**].

c. If the outside counsel identified in 3.b above are not acceptable to Tekmira due to a bona fide conflict of interest, the Parties shall agree on mutually acceptable outside counsel and the cost of transferring such cases shall be divided equally between Alnylam and Tekmira. If after [**] months from the effective date Tekmira wishes to transfer any of the above cases to an outside firm of their choosing and is such firm is acceptable to Alnylam, Tekmira shall be free to do so but the cost of transferring such cases shall be borne by Tekmira 100%.

d. If the Parties cannot agree on choice of outside counsel, each Party shall provide the names of three (3) law firms they find acceptable, excluding those firms the other Party found unacceptable, to the third party arbitrator as provided below and agree to abide by the decision of the arbitrator.

e. Starting on the Effective Date Tekmira shall control prosecution with input and agreement from Alnylam and shall diligently prosecute the Category 1 Patents claims in the broadest reasonable manner possible. Alnylam shall be copied on any correspondence with the respective patent offices related to the prosecution of the Category 1 Patents, and Tekmira shall consult Alnylam prior to any proposed filing, response or claim additions, deletions or amendments with sufficient time to allow for review, comment and agreement by Alnylam.

f. Alnylam shall be consulted and must agree on any inventorship determinations or any changes to inventorship prior to filing such changes with any patent office. In the event, however, that there is a disagreement between the Parties as to inventorship determinations, the Parties agree that they will be bound by the inventorship determinations made pursuant to the procedure outlined in paragraph 4.k below.

g. Except as otherwise set forth in 3.c above or 3.h below, prosecution and maintenance costs shall be divided equally between Alnylam and Tekmira for Category 1 Patents.

h. If for whatever reason Tekmira wishes to abandon an application for or cease to maintain any Category 1 Patents in a jurisdiction, Tekmira will provide Alnylam with [**] days advance notice and, if Alnylam wishes to maintain such application or patent, it will be at Alnylam's expense and such application or patent shall be assigned back to Alnylam, and Tekmira shall have no further rights in such application or patent and such application or patent shall cease to constitute Category 1 Patents.

i. Tekmira shall not have the right to utilize, refer to, incorporate or any way use to support claims, any subject matter that is explicitly disclosed in a patent application to which any of the Category 1 Patents claims priority that is also not explicitly disclosed in the Category 1 IP application in question or that is also not explicitly disclosed in other Tekmira owned or controlled patents or patent applications having an earlier filing date than the Category 1 Patent priority application containing such subject matter. For clarity, subject matter that is incorporated by reference or incorporated by virtue of a priority claim in the Category 1 Patents in question shall not in any way be used by Tekmira unless that subject matter is also explicitly disclosed in the Category 1 Patent in question or was explicitly disclosed in other Tekmira owned or controlled patent or patent applications having an earlier filing date than the Category 1 Patent or Category 1 Patent priority application in question.

j. Alnylam shall not have the right in any patent or patent application that it owns or controls, to utilize, refer to, incorporate or any way use to support claims in such patent or patent application, any subject matter that was explicitly disclosed in any of the Category 1 Patents by virtue of having a common priority document with any of the Category 1 Patents, unless it was explicitly disclosed in such Alnylam owned or controlled patent or patent application .

k. In the event there is a disagreement between the Parties on any prosecution matter (including new patent application filings, claims, claim amendments, deletions or additions), or any inventorship determination or correction they agree to utilize the dispute resolution mechanism as set forth in paragraph 7 below.

5. Prosecution and Maintenance of Category 2 Patents.

a. Prosecution and maintenance of Category 2 Patents shall be controlled by Alnylam and as to Category 2 Patents Alnylam shall have sole discretion in any decisions regarding patent prosecution and all prosecution and maintenance costs shall be borne by Alnylam.

b. Within [**] days of Tekmira providing the names of Tekmira inventors to be added to patent application [**] in Alnylam patent family [**], Alnylam shall add such inventors by filing with the US Patent and Trademark Office a corresponding correction, and the added inventors shall assign their rights in this application to Alnylam upon their addition to the application. Alnylam will similarly correct the inventorship in related US and foreign applications or patents where a claim or claims of similar scope exist.

c. Within [**] days of the Effective Date an inventorship determination shall be performed on all Category 2 Patents at Alnylam's expense.

d. If it is determined that Tekmira inventors should be added any application(s) or patent(s), Alnylam shall add such inventors by filing with the respective patent office a corresponding correction, and the added inventors shall assign their rights in this application to Alnylam upon their addition to the application.

e. If Tekmira disagrees with the above inventorship determination the Parties agree to utilize the dispute resolution mechanism as set forth in paragraph 7 below.

f. Tekmira shall be provided [**] days advance notice on any material claim amendments, additions or deletions in any Category 2 Patents that utilize or relate to disputed subject matter or if it decides to abandon any patent or patent application.

g. Tekmira shall be copied on all correspondence with the respective patent offices related to the prosecution of Category 2 Patents for which an inventorship determination referenced above results in the addition of a Tekmira inventor.

6. Prosecution and Maintenance of Category 3 Patents.

a. Prosecution and maintenance of Category 3 Patents shall be controlled by Alnylam and as to Category 3 Patents Alnylam shall have sole discretion in any decisions regarding patent prosecution and all prosecution and maintenance costs shall be borne by Alnylam.

b. Upon claim allowance an independent inventorship determination shall be made by Alnylam at its cost and inventorship shall be corrected if warranted. If Tekmira inventors are added to any applications, such inventors shall assign their rights to such patent applications to Alnylam.

c. In the event that Tekmira wishes to determine inventorship for any claim prior to allowance it may do so at its expense. If as a result of such determination Tekmira inventors are added to any applications, such inventors shall assign their rights to such patent applications to Alnylam

d. If Tekmira disagrees with the above inventorship determination, the Parties agree to utilize the dispute resolution mechanism as set forth in paragraph 7 below.

e. Tekmira shall be provided [**] days advance notice on any material claim amendments, additions or deletions in any Category 3 Patents that utilize or relate to disputed subject matter or if it decides to abandon any patent or patent application.

f. In addition to 6e above, Tekmira shall be copied on all correspondence with the respective patent offices related to the prosecution of such Tekmira Category 3 Patents for which an inventorship determination referenced above results in the addition of a Tekmira inventor.

7. Dispute Resolution Mechanism.

a. A third party gatekeeper/arbiter shall be identified along with a simple, speedy dispute resolution mechanism in the event of any disagreement among the Parties regarding the matters set forth in this Exhibit A.

b. The arbiter shall be mutually agreed to by the Parties. When a dispute arises among the Parties, the arbiter shall consider in good faith the position(s) of each Party in the dispute which the Parties shall have [**] business days to submit to such arbiter. The arbiter shall render his/her decision in an unbiased manner in accordance with the patent laws of the jurisdiction of the patent application as to which such disagreement pertains within [**] business days of receiving all relevant documentation from the Parties and, at the arbiter's discretion, discussion with the Parties; provided, however, that the arbiter shall hold no ex parte meetings or substantive conversations with a Party without the consent of the other Party.

c. In the event that the arbiter is no longer willing or capable of serving in this function a replacement shall be selected or if the Parties cannot agree to a replacement arbiter, one will be selected as follows:

i. Each of the Parties shall nominate five (5) potential arbiters and any potential arbiter appearing on both Parties' lists shall be the arbiter and the Parties shall attempt in good faith to secure such arbiter's services. In the event that there is more than one (1) arbiter that appears on both such lists, the Parties shall agree in good faith which arbiter to approach first. In the event that there are no arbiters in common, the Parties shall repeat the process until an arbiter appears on both such lists or until the Parties can otherwise agree on an arbiter.

d. The costs of the arbiter shall be divided equally between the Parties.

8. Cooperation.

a. The Parties hereby agree as to Category 1 Patents, Category 2 Patents, Category 3 Patents:

i. to make its employees, agents and consultants reasonably available to the other Party (or the other Party's authorized attorneys, agents or representatives), to the extent reasonably

necessary to enable such Party to undertake patent prosecution as contemplated by this Exhibit A;

ii. to cooperate, if necessary and appropriate, with the other Party in gaining patent term extensions wherever applicable to patent rights;

iii. to endeavor in good faith to coordinate its efforts wherever possible or reasonable with the other Party to minimize or avoid interference with the prosecution and maintenance of the other Party's patent applications;

iv. in the event one Party receives an obviousness-type double patenting rejection in an application such Party controls over an application controlled by the other Party, the Parties will enter into good faith discussions to take steps necessary to allow both sets of claims to issue, such steps potentially including assigning an ownership interest in the patent application in question to the other party so that common ownership is established allowing for the filing of a terminal disclaimer. In the event that such common ownership is established the Party receiving the ownership interest will license all of its rights back in such application to the other Party; and

v. Unless otherwise explicitly provided in this Agreement the Parties shall have rights with respect to the enforcement of Category 1 Patents, Category 2 Patents, Category 3 Patents according to their respective ownership interests in such patent rights as provided under applicable law.

9. For the avoidance of doubt, the Parties agree that, despite Tekmira's prior identification of the following patent families as being subject to an inventorship challenge by Tekmira, Tekmira does not challenge Alnylam's inventorship or sole ownership of the following patent families: [**].

SCHEDULE 1.9 - ALNYLAM EXISTING IN-LICENSES

1. Co-Exclusive License Agreement between Max Planck Innovation GmbH (formerly Garching Innovation GmbH) and Alnylam Pharmaceuticals, Inc., dated December 20, 2002, as amended by Amendment dated July 2, 2003, the Requirements Amendment effective June 15, 2005, the Waiver Amendment effective August 9, 2007 and the Amendment to the Alnylam Co-Exclusive License Agreement dated as of March 14, 2011, by and between Alnylam Pharmaceuticals, Inc., on the one hand, and Whitehead Institute for Biomedical Research, Massachusetts Institute of Technology and Max-Planck-Innovation GmbH, on the other hand; and Co-Exclusive License Agreement between Max Planck Innovation GmbH (formerly Garching Innovation GmbH) and Alnylam Europe AG (formerly Ribopharma AG), dated July 30, 2003

SCHEDULE 1.10 - ALNYLAM EXISTING SUBLICENSES

1. InterfeRx Option Agreement between AlCana Technologies, Inc., and Alnylam Pharmaceuticals, Inc., dated December 9, 2009

2. License and Collaboration Agreement between Alnylam Pharmaceuticals, Inc. and Ascletis Pharmaceuticals (Hangzhou) Co., Ltd., dated June 29, 2012

3. License and Collaboration Agreement between Alnylam Pharmaceuticals, Inc. and Genzyme Corporation, dated October 18, 2012

4. License and Collaboration Agreement between Monsanto Company and Alnylam Pharmaceuticals, Inc., dated August 27, 2012

5. Research Collaboration and License Agreement between Novartis Institutes for BioMedical Research, Inc. and Alnylam Pharmaceuticals, Inc., dated October 12, 2005, as amended by letter amendment dated May 1, 2011

6. Amended and Restated License and Collaboration Agreement among Alnylam Pharmaceuticals, Inc., Isis Pharmaceuticals, Inc., and Regulus Therapeutics Inc. (formerly Regulus Therapeutics LLC), dated January 1, 2009, as amended by amendments dated June 10, 2010 and October 25, 2011

7. License and Collaboration Agreement among F. Hoffmann-La Roche Ltd, Hoffman-La Roche Inc., and Alnylam Pharmaceuticals, Inc., dated July 8, 2007, as amended by letter amendment dated May 29, 2008 (assigned to Arrowhead Research Corporation in October 2011)

8. Collaboration Agreement among Alnylam Pharmaceuticals, Inc., F. Hoffmann-La Roche Ltd., and Hoffman-La Roche Inc., dated October 29, 2009 (assigned to Arrowhead Research Corporation in October 2011)

9. License and Collaboration Agreement between Takeda Pharmaceutical Company Limited and Alnylam Pharmaceuticals, Inc., dated May 27, 2008, as supplemented or amended by letter agreements dated August 18, 2009 and March 16, 2011

10. Supplemental Agreement among Alnylam Pharmaceuticals, Inc., Tekmira Pharmaceuticals Corporation, Protiva Biotherapeutics Inc., the University of British Columbia, and AlCana Technologies, Inc., dated July 27, 2009

SCHEDULE 1.15 – CERTAIN ALNYLAM PATENTS

Case Number	Country Name	Case Type	Application Status	Application Number	Filing Date	Patent Number	Issue Date
[**]	[**]	[**]	[**]	[**]	[**]		

A total of 19 pages were omitted and filed separately with the Securities and Exchange Commission pursuant to a request for confidential treatment. [**]

SCHEDULE 1.19 - CERTAIN BIODEFENSE TARGETS

Category A Pathogens:

BACTERIA:

[**]

VIRUSES:

[**]

Category B Pathogens:

BACTERIA:

[**]

VIRUSES:

[**]

Category C Pathogens

BACTERIA:

[**]

VIRUSES:

[**]

SCHEDULE 1.22 - CATEGORY 1 PATENTS

Case Number	Country Name	Law Firm	Case Type	Application Status	Application Number	Filing Date	Patent Number	Issue Date
[**]	[**]	[**]	[**]	[**]	[**]	[**]	[**]	[**]

A total of 8 pages were omitted and filed separately with the Securities and Exchange Commission pursuant to a request for confidential treatment. [**]

SCHEDULE 1.23 - CATEGORY 2 PATENTS

Case Number	Country Name	Law Firm	Case Type	Application Status	Application Number	Filing Date	Patent Number	Issue Date
[**]	[**]	[**]	[**]	[**]	[**]	[**]		

A total of 4 pages were omitted and filed separately with the Securities and Exchange Commission pursuant to a request for confidential treatment. [**]

SCHEDULE 1.24 - CATEGORY 3 PATENTS

Case Number	Country Name	Law Firm	Case Type	Application Status	Application Number	Filing Date	Patent Number	Issue Date
[**]	[**]	[**]	[**]	[**]	[**]	[**]		

A total of 6 pages were omitted and filed separately with the Securities and Exchange Commission pursuant to a request for confidential treatment. [**]

SCHEDULE 1.70 - TEKMIRA MANUFACTURING DOCUMENTS

Tekmira Manufacturing Documents are limited to the following documents provided to Alnylam by Tekmira:

1. Batch records or master batch records for [**]
2. The following technical protocols and reports: [**]
3. Specifications for raw materials, components and final products for [**]
4. The following technical presentations: [**]
6. Production Plans for [**]
7. Technical transfer plans for [**]
8. [**]
9. Minutes of Production Meeting telecons [**]

EXHIBIT 10.46

LICENSE AND COLLABORATION AGREEMENT

by and between

ALNYLAM PHARMACEUTICALS, INC.

and

THE MEDICINES COMPANY

CERTAIN CONFIDENTIAL PORTIONS OF THIS EXHIBIT WERE OMITTED AND REPLACED WITH "[***]". A COMPLETE VERSION OF THIS EXHIBIT HAS BEEN FILED SEPARATELY WITH THE SECRETARY OF THE SECURITIES AND EXCHANGE COMMISSION PURSUANT TO AN APPLICATION REQUESTING CONFIDENTIAL TREATMENT UNDER RULE 24b-2 OF THE SECURITIES EXCHANGE ACT OF 1934.

LICENSE AND COLLABORATION AGREEMENT

THIS LICENSE AND COLLABORATION AGREEMENT (this "**Agreement**"), effective as of February 3, 2013 (the "**Effective Date**"), by and between Alnylam Pharmaceuticals, Inc., a corporation organized and existing under the laws of the State of Delaware ("**Alnylam**") and, The Medicines Company, a corporation organized and existing under the laws of Delaware ("**MedCo**").

RECITALS:

WHEREAS, Alnylam owns or controls certain fundamental intellectual property relating to RNA interference, and is developing proprietary therapeutic products in the Field Targeting the human PCSK9 gene, including ALN-PCS02 and ALN-PCSsc (all as defined below);

WHEREAS, MedCo desires to develop and commercialize such products in the Territory (as defined below);

WHEREAS, Alnylam desires to collaborate with MedCo in the further development of such products in the Territory as set forth herein; and

WHEREAS, Alnylam and MedCo believe that a license and collaboration for such purpose on the terms and conditions of this Agreement would be desirable.

NOW, THEREFORE, in consideration of the foregoing premises and the mutual covenants herein contained, the Parties hereby agree as follows:

1. DEFINITIONS

Unless specifically set forth to the contrary herein, the following terms, whether used in the singular or plural, shall have the respective meanings set forth below:

1.1 [Intentionally Omitted].

1.2 "**Acquired Party**" has the meaning set forth in Section 6.7.

1.3 "**Acquirer**" has the meaning set forth in Section 6.7.

1.4 "**Additional Alnylam In-Licenses**" means the agreements set forth in Section C of Schedule D.

1.5 "**Affiliate**" means, with respect to a Person, any other Person which controls, is controlled by, or is under common control with the applicable Person. For purposes of this definition, "control" shall mean: (a) in the case of corporate entities, direct or indirect ownership of at least fifty percent (50%) of the stock or shares (or such lesser percentage which is the maximum allowed to be owned by a foreign corporation in a particular jurisdiction) entitled to vote for the election of directors, or otherwise having the power to control or direct the affairs of such Person; and (b) in the case of non-

corporate entities, direct or indirect ownership of at least fifty percent (50%) of the equity interest or the power to direct the management and policies of such non-corporate entities.

1.6 "**ALN-PCS02**" means the siRNA Product Controlled by Alnylam comprising the siRNA [***] formulated in a lipid-based nanoparticle, as further described on Schedule A.

1.7 "**ALN-PCSsc**" means an siRNA Product Controlled by Alnylam comprising an siRNA conjugated with a triantennary Ga1NAc molecule, as further described on Schedule B.

1.8 "**Alnylam Collaboration IP**" means (a) any improvement, discovery or Know-How, patentable or otherwise, first conceived or reduced to practice or, with respect to inventions and discoveries other than patentable inventions, otherwise identified, discovered, made or developed, solely by individuals who are employees, agents or consultants of Alnylam or its Affiliates and Controlled by Alnylam at any time during the Term, in each case in the conduct of the Collaboration, and (b) any Patent Rights which claim such improvements, discoveries or Know-How. Alnylam Collaboration IP excludes Alnylam's interest in Joint Collaboration IP. Patent Rights constituting Alnylam Collaboration IP are either Alnylam Core Technology Patent Rights or Alnylam Product-Specific Patent Rights, as the case may be.

1.9 "**Alnylam Core Technology Patent Rights**" means Patent Rights Controlled by Alnylam at any time during the Term that are reasonably necessary or useful to Develop, Manufacture or Commercialize Licensed Products, in each case other than Alnylam Product-Specific Patent Rights and Patent Rights comprising Joint Collaboration IP. Alnylam Core Technology Patent Rights includes the Patent Rights set forth on Schedule C-1 and may include Patent Rights that constitute Alnylam Collaboration IP.

1.10 "Alnylam Indemnitees" has the meaning set forth in Section 10.1.

1.11 "Alnylam In-Licenses" means (a) the Existing Alnylam In-Licenses and (b) any agreement between Alnylam (or its Affiliates) and a Third Party entered into after the Effective Date pursuant to which Alnylam acquires Control of Know-How or Patent Rights that are reasonably necessary or useful to Develop, Manufacture or Commercialize Licensed Products in the Field in the Territory, but in the case of any such agreement described in clause (b), solely to the extent that such agreement is designated as an Alnylam In-License pursuant to Section 6.4.2.2.

1.12 "Alnylam Know-How" means Know-How Controlled by Alnylam at any time during the Term that is reasonably necessary or useful to Develop, Manufacture and/or Commercialize Licensed Products in the Field in the Territory.

1.13 "**Alnylam Patent Rights**" means Alnylam Core Technology Patent Rights and Alnylam Product-Specific Patent Rights.

1.14 "**Alnylam Product-Specific Patent Rights**" means Patent Rights Controlled by Alnylam at any time during the Term that solely claim (a) an siRNA Targeting the human PCSK9 gene contained in a Licensed Product, and pharmaceutical compositions thereof; (b) an siRNA Product or

specific components thereof to the extent that such components are unique to said siRNA Products; (c) methods of using the compositions described in clause (a) or (b) above as a human therapeutic or prophylactic, or to Target the human PCSK9 gene, or to inhibit expression of human PCSK9, and foreign equivalents of such method claims; (d) methods and compositions directed to the synthesis or analysis of the compositions described in clause (a) or (b); or (e) Alnylam Collaboration IP that is applicable solely to a Licensed Product; *provided, however*, that (y) any such patents that include claims that are directed to subject matter applicable to siRNA or siRNA delivery in general will not be considered Alnylam Product-Specific Patent Rights but will be considered Alnylam Core Technology Patent Rights. Alnylam Product-Specific Patent Rights excludes Joint Collaboration IP, includes the Patent Rights set forth on Schedule C-2 and may include Patent Rights that constitute Alnylam Collaboration IP.

1.15 "Alnylam Technology" means, collectively, Alnylam Know-How, Alnylam Patent Rights, Alnylam Collaboration IP and Alnylam's interest in Joint Collaboration IP.

1.16 "Bankrupt Party" has the meaning set forth in Section 6.5.

1.17 "Breaching Party" has the meaning set forth in Section 12.2.2.

1.18 "**Bulk Drug Product**" means formulated Bulk Drug Substance in bulk form prior to filling and finishing.

1.19 "**Bulk Drug Substance**" means an siRNA (including chemical modifications and covalent conjugates) or other active ingredient in bulk form manufactured for use as an active pharmaceutical ingredient in a Licensed Product.

1.20 "**Business Day**" means a day on which banking institutions in Boston, Massachusetts, USA and Parsippany, New Jersey, USA are open for business, excluding any Saturday or Sunday.

1.21 "Calendar Quarter" means the respective periods of three (3) consecutive calendar months ending on March 31, June 30, September 30 and December 31 of each Calendar Year; *provided*, that (a) the first Calendar Quarter of the Term shall begin on the Effective Date and end on the first to occur of March 31, June 30, September 30 or December 31 thereafter and the last Calendar Quarter of the Term shall end on the last day of the Term, and (b) the first Calendar Quarter of a Royalty Term for a Licensed Product in a country shall begin on the First Commercial Sale of such Licensed Product in such country and end on the first to occur of March 31, June 30, September 30 or December 31 thereafter and the last Calendar Quarter of a Royalty Term shall end on the last day of such Royalty Term.

1.22 "Calendar Year" means each successive period of twelve (12) months commencing on January 1 and ending on December 31; *provided*, that (a) the first Calendar Year of the Term shall begin on the Effective Date and end on the first December 31 thereafter and the last Calendar Year of the Term shall end on the last day of the Term, and (b) the first Calendar Year of a Royalty Term for a Licensed Product in a country shall begin on the First Commercial Sale of such Licensed Product in

such country and end on the first December 31 thereafter and the last Calendar Year of the Term shall end on the last day of such Royalty Term.

1.23 "**Challenge**" has the meaning set forth in Section 12.2.4.

1.24 "**Challenging Party**" has the meaning set forth in Section 12.2.4.

1.25 "**Change of Control**" means, with respect to a Party, any of the following: (a) the sale or disposition of all or substantially all of the assets of such Party or its direct or indirect controlling Affiliate to a Third Party, other than to an entity of which more than fifty percent (50%) of the voting capital stock are owned after such sale or disposition by shareholders of such Party or its direct or indirect controlling Affiliate (in either case, whether directly or indirectly through any parent entity); or (b) (i) the acquisition by a Third Party, alone or together with any of its Affiliates, other than an employee benefit plan (or related trust) sponsored or maintained by such Party or any of its Affiliates, of more than fifty percent (50%) of the outstanding shares of voting capital stock of such Party or its direct or indirect controlling Affiliate, or (ii) the acquisition, merger or consolidation of such Party or its direct or indirect controlling Affiliate with or into another Person, other than, in the case of this clause (b), an acquisition or a merger or consolidation of such Person or its controlling Affiliate in which the holders of shares of voting capital stock of such Person or its controlling Affiliate, as the case may be, immediately prior to such acquisition, merger or consolidation will beneficially own, directly or indirectly, at least fifty percent (50%) of the shares of voting capital stock of the acquiring Third Party or the surviving corporation in such acquisition, merger or consolidation, as the case may be, immediately after such acquisition, merger or consolidation.

1.26 "**Clinical Study**" means a Phase I Study, Phase II Study, Phase III Study, or Pivotal Study, as applicable; but excluding any Post-Approval Studies.

1.27 "**Collaboration**" means the activities of the Parties in the Development and Manufacture of Licensed Products under this Agreement and/or the Development Supply Agreement.

1.28 **"Combination Product"** has the meaning set forth in Section 1.89.

1.29 **"[***]"** has the meaning set forth in Section 7.4.4.

1.30 **"[***]"** has the meaning set forth in Section 7.4.4.

1.31 "**Commercialization**" or "**Commercialize**" means any and all activities directed to marketing, promoting, distributing, importing, exporting, offering to sell and/or selling a product, including the conduct of Post-Approval Studies, and activities directed to obtaining pricing and reimbursement approvals, as applicable.

1.32 "**Commercially Reasonable Efforts**" means (a) with respect to the obligations of a Party under this Agreement that relate to the Development, Manufacture or Commercialization of a Licensed Product, the carrying out of such obligations in a diligent, expeditious and sustained manner using efforts and resources, including reasonably necessary personnel and financial resources, that

biopharmaceutical companies of comparable size to, and comparable resources of, such Party typically devote to their own products of similar market potential at a similar stage in development or product life, taking into account the following factors to the extent reasonable and relevant: issues of safety and efficacy, product profile, competitiveness of such Licensed Product and alternative Third Party products (but not alternative products Controlled by the Party to which the efforts obligation applies which are not Licensed Products) in the marketplace, the patent or other proprietary position of such Licensed Product, the regulatory structure involved and the potential profitability of such Licensed Product marketed or to be marketed, but excluding from consideration any financial considerations of MedCo to Alnylam under this Agreement; *provided*, *however*, that to the extent the obligations of MedCo under this Agreement relate to the Development, Manufacture or Commercialization of a Licensed Product for China, such efforts and resources shall instead be those that MedCo typically devotes to its own products of similar market potential at a similar stage in development or product life, taking into account the factors set forth above; and (b) with respect to other obligations under this Agreement, the carrying out of such obligations in a diligent, expeditious and sustained manner using efforts and resources, including reasonably necessary personnel and financial resources, that biopharmaceutical companies of comparable size and resources typically devote to similar obligations.

1.33 "**Competitive Infringement**" has the meaning set forth in Section 11.4.1.

1.34 "**Confidential Information**" means with respect to a Party but subject to Section 8.1(a)(i)-(iv), any and all confidential or proprietary information and data, including (with respect to Alnylam as the disclosing Party) Alnylam Technology, (with respect to MedCo as the disclosing Party) MedCo Technology, and all other scientific, pre-clinical, clinical, regulatory, manufacturing, marketing, financial and commercial information or data, whether communicated in writing or orally or by any other method, which is provided by one Party to the other Party in connection with this Agreement. Alnylam Technology is Confidential Information of Alnylam. MedCo Technology is Confidential Information of MedCo. Joint Collaboration IP is the Confidential Information of both Parties, with each Party being considered both the disclosing Party and the receiving Party.

1.35 "**Control**", "**Controls**" or "**Controlled by**" means, with respect to any Know-How, Patent Right or other intellectual property right and a Party, the ability of such Party or its Affiliates (whether by ownership or license, other than pursuant to a license granted under this Agreement) to assign, transfer, or grant access to, or a license or sublicense of, such item or right as provided for herein without violating the terms of any agreement or other arrangement with any Third Party; *provided* that, with respect to rights to any Third Party Know-How, Patent Rights or other intellectual property right that are licensed to, or otherwise obtained by, (i) a Party or its Affiliates pursuant to an agreement entered into by such Party or any of its Affiliates after the Effective Date or (ii) Alnylam or its Affiliates pursuant to any Additional Alnylam In-License, such Third Party Know-How, Patent Rights or other intellectual property right shall be deemed not to be under the Control of such Party or its Affiliates, or Alnylam or its Affiliates, respectively, unless and until the agreement pursuant to which such rights are obtained becomes an In-License pursuant to Section 6.4.2.

1.36 "**Costs**" means (a) with respect to the Development, (i) the direct and documented out-of-pocket costs and expenses incurred by a Party or its Affiliates in conducting activities under the

Transaction Agreements, and (ii) FTE Costs of internal personnel that are attributable or reasonably allocable to such activities, in each case as determined in accordance with GAAP, and (b) with respect to the supply of Licensed Product by Alnylam pursuant to Sections 5.1(a)(i) and (ii), the reasonable internal and external costs of Alnylam incurred in Manufacturing or having Manufactured such Licensed Product (i) to the extent that such Licensed Product is Manufactured by Alnylam, the fully allocated cost of Manufacture of such Licensed Product, consisting of direct material and direct labor costs, plus Manufacturing overhead attributable to such Licensed Product (including facilities start-up costs, all directly incurred Manufacturing variances and a reasonable allocation of related Manufacturing administrative and facilities costs for such Licensed Product, but excluding corporate administrative overhead and/or costs associated with excess capacity), all calculated strictly in accordance with GAAP consistently applied by Alnylam, and (ii) to the extent that such Licensed Product is Manufactured by a Third Party manufacturer, the actual fees paid by Alnylam to the Third Party for the Manufacture, supply and packaging of such Licensed Product and any reasonable costs, including direct labor costs, actually incurred by Alnylam in managing or overseeing the Third Party relationship.

1.37 "**Cover**," "**Covering**" or "**Covers**" means, as to a product and Patent Rights, that, in the absence of a license granted under, or ownership of, such Patent Rights, the research, development, manufacture, use, offer for sale, sale, or importation of such product would infringe such Patent Rights or, as to a pending claim included in such Patent Rights, the research, development, manufacture, use, offer for sale, sale, or importation of such product would infringe such Patent Rights if such pending claim were to issue in an issued patent.

1.38 "**Development**," "**Developing**" or "**Develop**" means the research and development of Licensed Products, including activities related to the generation, characterization, optimization, construction, expression, use and production of Licensed Products, any other research and development activities related to the testing and qualification of Licensed Products, including toxicology studies, statistical analysis and report writing, pre-clinical testing, Clinical Studies and regulatory affairs, product approval and registration activities, but excluding Post-Approval Studies.

1.39 "**Development Costs Cap**" has the meaning set forth in Section 2.3.1.

1.40 "**Development Supply Agreement**" has the meaning set forth in Section 5.1.

1.41 "**Dispute**" has the meaning set forth in Section 13.12.

1.42 "**Effective Date**" has the meaning set forth in the preamble.

1.43 "**EMA**" means the European Medicines Agency and any successor governmental authority having substantially the same function.

1.44 "**EU**" means the European Union, as its membership may be altered from time to time, and any successor thereto.

1.45 **"[***]"** has the meaning set forth in Section 7.4.4.

1.46 [Intentionally Omitted].

1.47 **"Existing Alnylam In-Licenses"** means (a) the Third Party agreements identified as such in Section A of Schedule D and (b) any Additional Alnylam In-License included within the definition of Existing Alnylam In-Licenses pursuant to Section 6.4.2.3.

1.48 **"Existing Alnylam Third Party Agreements"** means the Third Party agreements identified as such in Section B of Schedule D.

1.49 "**Extra Early Development Costs**" has the meaning set forth in Section 2.3.1.

1.50 "**FDA**" means the United States Food and Drug Administration and any successor governmental authority having substantially the same function.

1.51 "**Field"** means the treatment, palliation and/or prevention of all human diseases.

1.52 "**Finished Product**" means the finished product formulation of a Licensed Product, containing Bulk Drug Product, filled into unit packages (but excluding, in the case of supply by Alnylam or its Affiliates, any automated delivery device such as an "autoinjector") for final labeling and packaging.

1.53 **"First Commercial Sale"** means, with respect to a Licensed Product in a country, the first sale by MedCo or its Related Parties for end use or consumption of such Licensed Product in such country after all Regulatory Approvals legally required for such sale have been granted by the Regulatory Authority of such country.

1.54 "**FTE**" means [***] hours of work devoted to or in support of the Development or Manufacture of a Licensed Product, that is carried out by one or more qualified scientific or technical employees or contract personnel of a Party or its Affiliates.

1.55 "**FTE Cost**" means, for any period, the FTE Rate multiplied by the number of FTEs in such period; *provided*, *however*, that for purposes of such calculation, no individual may account for more than one FTE in any Calendar Year.

1.56 "**FTE Rate**" means [***] U.S. Dollars ($[***]) per FTE, increased annually beginning on January 1, 2014 and thereafter on January 1 of each succeeding year by the percentage increase in the CPI as of December 31 of the then most recently ended calendar year over the level of the CPI on December 31, 2012. As used in this definition, "CPI" shall mean the Consumer Price Index – Urban Wage Earners and Clerical Workers, U.S. City Average, All Items, 1982-84 = 100, published by the United States Department of Labor, Bureau of Labor Statistics (or its successor equivalent index) in the United States.

1.57 "**GAAP**" means generally accepted accounting principles as practiced in the United States or, to the extent applicable, IFRS (International Financial Reporting Standards).

1.58 "**Generic Competition**" has the meaning set forth in Section 7.4.3.

1.59 "**Generic Product**" means, with respect to a Licensed Product in a country, another pharmaceutical product that (a) is sold by a Third Party other than a Related Party of MedCo under license from Medco in such country, (b) is authorized for use in such country in one or more of the indications for which such Licensed Product has Regulatory Approval in such country, (c) contains the same active ingredient(s) as such Licensed Product or a bioequivalent thereof, and (d) was approved for sale in such country by reference to the same or a subset of the same information that was used for obtaining the Regulatory Approval for such Licensed Product in such country without such Third Party being granted a license to such information by MedCo or its Related Parties.

1.60 "**Governmental Authority**" means any applicable government authority, court, tribunal, arbitrator, agency, legislative body, commission or other instrumentality of (a) any government of any country or territory, (b) any state, province, county, city or other political subdivision thereof or (c) any supranational body.

1.61 "**IND**" means an Investigational New Drug application, Clinical Trial Application or similar application or submission for approval to conduct human clinical investigations filed with or submitted to a Regulatory Authority in conformance with the requirements of such Regulatory Authority.

1.62 "**Indemnitee**" has the meaning set forth in Section 10.3.

1.63 "**Initial Development Budget**" has the meaning set forth in Section 2.2.1.

1.64 "**Initial Development Plan**" has the meaning set forth in Section 2.2.1.

1.65 "**In-Licenses**" means, collectively, the Alnylam In-Licenses and the MedCo In-Licenses.

1.66 "**Joint Collaboration IP**" means, collectively, (a) any improvement, discovery or Know-How, patentable or otherwise, first conceived or reduced to practice or, with respect to inventions and discoveries other than patentable inventions, otherwise identified, discovered, made or developed, jointly by individuals who are employee(s), agent(s) or consultant(s) of Alnylam or its Affiliates, on the one hand, and individuals who are employee(s), agent(s) or consultant(s) of MedCo or its Affiliates, on the other hand, in the conduct of the Collaboration, and (b) any Patent Rights which claim such improvements, discoveries or Know-How during the Term.

1.67 **"Joint Steering Committee"** or **"JSC"** means the joint steering committee as more fully described in Section 4.1.

1.68 "**Know-How**" means any biological materials and other tangible materials or intangible information, including inventions, practices, methods, protocols, formulas, knowledge, know-how, trade secrets, processes, assays, skills, experience, techniques, governmental or regulatory correspondence (including conversation logs), and results of experimentation and testing, including

pharmacological, toxicological and pre-clinical and clinical test data and analytical and quality control data, patentable or otherwise.

1.69 "**Laws**" means all applicable laws, statutes, rules, regulations, orders, judgments, injunctions, ordinances or other pronouncements having the binding effect of law of any Governmental Authority.

1.70 **"Lead Product"** has the meaning set forth in Section 2.2.2.

1.71 **"Licensed Compound"** has the meaning set forth in Section 1.89.

1.72 "**Licensed Product**" means any siRNA Product, including ALN-PCS02 and ALN-PCSsc.

1.73 "**Licensing Party**" has the meaning set forth in Section 6.4.2.2.

1.74 "**Licensor Party**" has the meaning set forth in Section 12.2.4.

1.75 "**Losses**" has the meaning set forth in Section 10.1.

1.76 "**Major Market Country**" means the United States, the United Kingdom, France, Germany, Italy, Spain, Japan, or China.

1.77 "**Manufacturing**" or "**Manufacture**" means, as applicable, all activities associated with the production, manufacture, processing, filling, finishing, packaging, labeling, shipping, and storage of a Licensed Product (including Bulk Drug Substance, Bulk Drug Product and Finished Product), including process and formulation development, process validation, stability testing, manufacturing scale-up, pre-clinical, clinical and commercial manufacture and analytical development, product characterization, quality assurance and quality control development, testing and release.

1.78 "**MedCo Collaboration IP**" means (a) any improvement, discovery or Know-How, patentable or otherwise, first conceived or reduced to practice or, with respect to inventions and discoveries other than patentable inventions, otherwise identified, discovered, made or developed, solely by individuals who are employees, agents or consultants of MedCo or its Affiliates and Controlled by MedCo at any time during the Term, in each case in the conduct of the Collaboration or otherwise under this Agreement, and (b) any Patent Rights which claim such improvements, discoveries or Know-How. MedCo Collaboration IP excludes MedCo's interest in Joint Collaboration IP.

1.79 "**MedCo Commercialization Plan**" has the meaning set forth in Section 3.2.

1.80 "**MedCo Development Plan**" has the meaning set forth in Section 2.2.3.

1.81 "**MedCo Improvements**" means any improvement, discovery or Know-How, patentable or otherwise, that (a) is first conceived or reduced to practice, or with respect to inventions

and discoveries other than patentable inventions, otherwise identified, discovered, made or developed, solely by individuals who are employees, agents or consultants of MedCo or its Affiliates in the course of conducting Development, Manufacturing or Commercialization activities with respect to Licensed Products under this Agreement, (b) is Controlled by MedCo or its Affiliates, and (c) constitutes (i) a new use or method of use of, or a new indication for, a Licensed Product, or (ii) an improvement that would otherwise be dominated by Alnylam Technology, including, as applicable, formulation technology. For clarity, MedCo Improvements excludes device technology for the administration of a pharmaceutical product to a human.

1.82 "**MedCo Indemnitees**" has the meaning set forth in Section 10.2.

1.83 "**MedCo In-License**" means any agreement between MedCo (or its Affiliates) and a Third Party pursuant to which MedCo Controls Know-How or Patent Rights that are reasonably necessary or useful for the Development, Manufacture and/or Commercialization of Licensed Products in the Territory, but solely to the extent, if any, that such agreement is designated as a MedCo In-License pursuant to Section 2.4(b).

1.84 "MedCo Know-How" means Know-How in MedCo Collaboration IP and MedCo's rights in Know-How comprising Joint Collaboration IP.

1.85 "**MedCo Patent Rights**" means Patent Rights in MedCo Collaboration IP (other than MedCo's rights in Patent Rights comprising Joint Collaboration IP).

1.86 "**MedCo Technology**" means, collectively, MedCo Know-How, MedCo Patent Rights, MedCo Collaboration IP and MedCo's interest in Joint Collaboration IP.

1.87 "MicroRNA Mimic" means a double-stranded or single-stranded oligonucleotide or analog thereof with a substantially similar base composition as a particular microRNA and which is designed to mimic the activity of such microRNA.

1.88 "NDA" means a New Drug Application, Biologics License Application, Marketing Authorization Application or similar application or submission filed with a Regulatory Authority in a country or group of countries to obtain marketing approval for a biological, pharmaceutical or other therapeutic or prophylactic product in that country or in that group of countries.

1.89 "**Net Sales**" means, for any period and for any country in the Territory, the total aggregate amount billed during such period in such country by MedCo, its Affiliates and its Sublicensees in such country for all sales of the Licensed Products to Third Parties (other than to a Sublicensee of MedCo or its Affiliates) after deducting, if not previously deducted, from the amount invoiced or received, the following deductions to the extent actually applied or taken with respect to such sales of Licensed Products:

(a) discounts (including trade, cash and quantity discounts), cash and non-cash coupons, charge back payments and rebates granted to managed health care organizations or to federal, state and local governments, their agencies, and purchasers and reimbursers or to customers;

(b) actually granted credits, allowances, discounts to and chargebacks for claims, spoiled, damaged or outdated goods, rejections or returns of the Licensed Products, including Licensed Products returned in connection with recalls or withdrawals;

(c) taxes and duties paid, absorbed or allowed which are directly related to the sale of the Licensed Product;

(d) actual freight and insurance costs incurred in transporting the Licensed Product to customers;

(e) discounts or rebates or other payments required by applicable Law, including any governmental special medical assistance programs;

(f) customs duties, surcharges and other governmental charges incurred in connection with the exportation or importation of the Licensed Product;

(g) fee-for-service wholesaler fees, GPO administrative fees, inventory management fees paid to wholesalers, and any similar fees reasonably allocated to the Licensed Product, to the extent consistent with the usual course of dealing of MedCo or the applicable Related Party for its products other than a Licensed Product;

(h) amounts that are written off as uncollectible in accordance with the accounting procedures of MedCo or the applicable Related Party, consistently applied; *provided*, that if any such written-off amounts are subsequently collected, such collected amounts shall be included in Net Sales in the period in which they are subsequently collected; and

(i) any other deduction to revenue that is not described above which is required to be recorded as an adjustment to gross revenue for financial reporting purposes.

Such amounts shall be determined from the books and records of MedCo or its Related Parties, maintained in accordance with GAAP, consistently applied.

If any Licensed Product is sold as a Combination Product (as defined below), the Net Sales from the Combination Product, for the purposes of determining milestones and royalties, shall be determined by multiplying the Net Sales of the Combination Product during the applicable Calendar Quarter, by the fraction, A/(A+B), where A is the average sale price of a Sole Compound Product (as defined below) when sold separately in finished form and B is the average sale price of the other active compounds or active ingredients included in the Combination Product when sold separately in finished form, in each case during the applicable Calendar Quarter or, if sales of both the Sole Compound Product and the other active compounds or active ingredients did not occur in such period, then in the most recent Calendar Quarter in which sales of both occurred. If such average sale price cannot be determined for both the Sole Compound Product and all other active compounds or active ingredients included in the Combination Product, Net Sales for the purposes of determining milestones and royalties shall be calculated by multiplying the Net Sales of the Combination Product by the fraction of C/(C+D) where C is the fair market value of the Sole Compound Product and D is the fair market value of all other

active compounds or active ingredients included in the Combination Product. In such event, MedCo shall in good faith make a determination of the respective fair market values of the Sole Compound Product and all other active compounds or active ingredients included in the Combination Product, and shall notify Alnylam of such determination and provide Alnylam with MedCo's basis for such determination. If Alnylam in good faith does not agree with such determination, Alnylam shall give MedCo written notice of its disagreement within thirty (30) days after receiving the relevant report pursuant to Sections 7.3 or 7.4, and the provisions of Section 13.12 shall apply. "**Licensed Compound**" means an siRNA Product subject to a license granted by Alnylam to MedCo under Section 6.1. "**Combination Product**" means a product that contains one or more Licensed Compounds and one or more therapeutically active compounds or active ingredients that are *not* Licensed Compounds. "**Sole Compound Product**" means a product containing no active compounds or active ingredients other than a Licensed Compound.

In the case of any sale or other disposal for value, such as barter or counter-trade, of Licensed Product, or part thereof, other than in an arm's length transaction exclusively for cash, Net Sales shall be calculated as above on the value of the non-cash consideration received or the fair market price (if higher) of the Licensed Product in the country of sale or disposal, as determined in accordance with GAAP.

Sales between or among MedCo and its Related Parties shall be excluded from the computation of Net Sales, but Net Sales shall include sales to the first Third Party (other than a Sublicensee of MedCo or its Affiliate) thereafter by MedCo or its Related Parties.

1.90 "**Non-Acquired Party**" has the meaning set forth in Section 6.7.

1.91 **"Non-Bankrupt Party"** has the meaning set forth in Section 6.5.

1.92 **"Non-Breaching Party"** has the meaning set forth in Section 12.2.2.

1.93 **"Party"** means MedCo and/or Alnylam.

1.94 **"Patent Rights"** means all patents (including all reissues, extensions, substitutions, confirmations, re-registrations, re-examinations, supplementary protection certificates and patents of addition) and patent applications (including all provisional applications, requests for continuation, continuations, continuations-in-part and divisionals) and all equivalents of the foregoing in any country of the world.

1.95 **"Payee"** has the meaning set forth in Section 7.9.1.

1.96 **"Paying Party"** has the meaning set forth in Section 7.9.1.

1.97 "**[***]**" means the [***].

1.98 "**Person**" shall mean any natural person, corporation, unincorporated organization, partnership, association, joint stock company, joint venture, limited liability company, trust, Governmental Authority, or any other entity.

1.99 "**Pharmacovigilance Agreement**" has the meaning set forth in Section 2.6.3.

1.100 "Phase I Completion" means [***].

1.101 "**Phase I Study**" means a study in humans which provides for the introduction into humans of a product, conducted in healthy volunteers or patients, to obtain initial information on product safety, tolerability, pharmacological activity or pharmacokinetics, as more fully defined in 21 C.F.R. § 312.21(a) (or the equivalent thereof outside the United States).

1.102 "Phase I/II Study" means a single study in humans that includes a Phase I Study and a Phase II Study.

1.103 "**Phase II Study**" means a study in humans of the safety, dose ranging or efficacy of a product, as further defined in 21 C.F.R. § 312.21(b) (or the equivalent thereof outside the United States).

1.104 "**Phase III Study**" means a study in humans of the efficacy and safety of a product, which is prospectively designed to demonstrate statistically whether such product is effective and safe for use in a particular indication in a manner sufficient (alone or together with one or more other such studies) to file an application for Regulatory Approval for such product, as further defined in 21 C.F.R. § 312.21(c) (or the equivalent thereof outside the United States).

1.105 "Pivotal Study" means a controlled pivotal clinical study of a product that is prospectively designed to demonstrate statistically whether such product is effective and safe for use in a particular indication in a manner sufficient to obtain Regulatory Approval to market such product in a Major Market Country.

1.106 "**Post-Approval Study**" means a clinical study of a Licensed Product initiated in a country after receipt of Regulatory Approval for such Licensed Product in such country.

1.107 "**Pre-Existing Affiliates**" has the meaning set forth in Section 6.7.

1.108 "**Product Trademark(s)**" means the trademark(s) and service mark(s) for use in connection with the distribution, marketing, promotion and sale of Licensed Products, and/or accompanying logos, trade dress and/or indicia of origin. Product Trademarks specifically excludes the corporate names and logos of the Parties and their Related Parties.

1.109 "**Regulatory Approval"** means any and all approvals, licenses, registrations or authorizations of any Regulatory Authority that are necessary for the marketing and sale of a pharmaceutical product in a country or group of countries, including pricing and/or reimbursement

approval in any country in which pricing and/or reimbursement approval is required by applicable Laws.

1.110 "**Regulatory Authority**" means any applicable government regulatory authority involved in granting approvals for the Development, Manufacturing and/or Commercialization of any Licensed Product, including the FDA and the EMA.

1.111 **"Regulatory Lead"** has the meaning set forth in Section 2.6.1.

1.112 "**Regulatory Exclusivity**" means, with respect to a Licensed Product in a country, any exclusive marketing right, data exclusivity right, orphan drug designation, or another exclusive right which would prevent a Generic Product version of such Licensed Product from being marketed or sold in such country, conferred by any Governmental Authority with respect to such Licensed Product in such country, other than a Patent Right.

1.113 "**Related Party**" means, with respect to a Party, such Party's Affiliates and permitted Sublicensees.

1.114 **"Royalty Term"** has the meaning set forth in Section 7.4.2.

1.115 **"Sales Milestone"** has the meaning set forth in Section 7.3.

1.116 **"Selection Date"** has the meaning set forth in Section 2.2.2.

1.117 **"siRNA"** means a double-stranded ribonucleic acid (RNA) composition designed to act primarily through an RNA interference mechanism that consists of either (a) two separate oligomers of native or chemically modified RNA that are hybridized to one another along a substantial portion of their lengths, or (b) a single oligomer of native or chemically modified RNA that is hybridized to itself by self-complementary base-pairing along a substantial portion of its length to form a hairpin.

1.118 **"siRNA Product"** means an siRNA composition designed to Target the human PCSK9 gene through an RNA interference mechanism, and which is not a microRNA, microRNA antagonist or MicroRNA Mimic.

1.119 **"Sole Compound Product"** has the meaning set forth in Section 1.89.

1.120 "**Sublicensed Party**" has the meaning set forth in Section 6.4.1.2.

1.121 "**Sublicensee**" means, with respect to MedCo or Alnylam, as the case may be, a Third Party to whom such Party grants a sublicense under any Alnylam Technology or MedCo Technology, respectively, to Develop, Manufacture or Commercialize a Licensed Product in the Field pursuant to Section 6.1.3 or Section 6.2.3, and, with respect to Alnylam, a Third Party to whom Alnylam grants a sublicense pursuant to Section 6.2.3 under any MedCo Improvements licensed to Alnylam pursuant to Section 6.2.2.

1.122 "**Sublicensor Party**" has the meaning set forth in Section 6.4.1.2.

1.123 "**Target" or "Targeting**" means, with respect to an siRNA and a target gene, that such siRNA antagonizes the expression of the messenger RNA of such target gene, and with respect to a product and a target gene, that such product contains an siRNA that antagonizes the expression of the messenger RNA of such target gene.

1.124 **"Term"** has the meaning set forth in Section 12.1.

1.125 **"Territory"** means all countries of the world.

1.126 **"Third Party"** means an entity other than the Parties and their Affiliates.

1.127 "**Third Party License Payment**" means royalties, upfront fees, milestones or other amounts payable under an In-License.

1.128 **"Transaction Agreements"** means, collectively, this Agreement, the Development Supply Agreement, any quality agreement between the Parties with respect to the supply of Licensed Product and the Pharmacovigilance Agreement.

1.129 "**United States**" means the United States of America and its territories, possessions and commonwealths.

1.130 "**Valid Claim**" means a claim of: (a) an issued and unexpired Patent Right, which claim has not been (i) revoked or held unenforceable, unpatentable or invalid by a decision of a court or other governmental agency of competent jurisdiction, which is not appealable or has not been appealed within the time allowed for appeal, or (ii) abandoned, disclaimed, denied or admitted to be invalid or unenforceable through reissue, re-examination or disclaimer or otherwise, or (b) a patent application that has been pending less than [***] from the date of filing of the earliest patent application from which such patent application claims priority, which claim has not been cancelled, withdrawn or abandoned, or finally rejected by an administrative agency action from which no appeal can be taken.

2. DEVELOPMENT COLLABORATION

2.1 **Overview**. Prior to the Effective Date, Alnylam has been engaged in the Development of Licensed Products. Under this Agreement, the Parties will collaborate in the further Development of Licensed Products, with Alnylam retaining all responsibility for the Development of Licensed Products until Phase I Completion as set forth in the Initial Development Plan, and MedCo assuming all other responsibility for the Development of Licensed Products. Initially the Collaboration will include the Development of both ALN-PCS02 and ALN-PSCsc in parallel. In accordance with the process described below, the Parties intend to select one of ALN-PCS02 or ALN-PSCsc for ongoing Development prior to the initiation of IND-enabling studies described in the Initial Development Plan.

2.2 **Development Plans**.

2.2.1 **Initial Global Development Plan**. The Development activities to be undertaken by Alnylam with respect to Licensed Products in the Territory prior to Phase I Completion will be set forth in a written workplan and timetable (the "**Initial Development Plan**"), which plan includes the Development activities to be undertaken (and all of which will be conducted by Alnylam) with respect to Licensed Products prior to Phase I Completion, and an estimated budget for such Development activities ("**Initial Development Budget**"). A draft of the Initial Development Plan is attached hereto as Schedule E. Alnylam shall submit an update to the Initial Development Plan for review and approval by the JSC of any material modifications or updates within forty-five (45) days of the Effective Date and thereafter on at least a semi-annual basis. The JSC shall have the right to modify the Initial Development Plan during such review and approval but only to the extent consistent with the budget and timelines contained in the Initial Development Plan attached hereto as Schedule E or as otherwise agreed by the Parties.

2.2.2 **Selection of Lead Product**. Within thirty (30) days after the Selection Date (as defined below), the JSC shall designate one of ALN-PCS02 and ALN-PCSsc as the product to continue to Develop under the Collaboration (the designated product, the "**Lead Product**"). "**Selection Date**" means [***].

2.2.3 **MedCo Development Plan**. The global Development activities to be undertaken with respect to Licensed Products by MedCo, or, to the extent agreed upon by the Parties in writing, by Alnylam following Phase I Completion, will be set forth in a rolling [***] written workplan and timetable (the "**MedCo Development Plan**") to be prepared, subject to JSC approval, by MedCo. Within [***] days after filing of the IND for the Lead Product in accordance with the Initial Development Plan, MedCo shall provide the initial MedCo Development Plan to the JSC for review and approval. The MedCo Development Plan shall subsequently be updated by MedCo from time to time and no less frequently than twice per Calendar Year, subject to JSC approval.

2.3 Responsibilities for Development Activities.

2.3.1 **Initial Development Plan**. Alnylam shall be responsible for the global Development of Licensed Products and all Development activities with respect thereto through Phase I Completion as set forth in the Initial Development Plan. Alnylam shall be responsible for one hundred percent (100%) of all Costs for the Development activities that are conducted by Alnylam for the Licensed Product in the Territory pursuant to the Initial Development Plan up to a total of (a) [***] dollars ($[***]), prior to the receipt by Alnylam of the Milestone Payment in Section 7.2(a)(i), or (b) [***] ($[***]), upon receipt by Alnylam of the Milestone Payment in Section 7.2(a)(i) (such amount in (a) or (b), the relevant "**Development Costs Cap**"); *provided*, *however*, that, Alnylam shall also bear any Costs for Development activities conducted by Alnylam pursuant to the Initial Development Plan that exceed such amount to the extent such excess Costs [***]. MedCo shall be responsible for all Costs with respect to Development activities for the Licensed Product pursuant to the Initial Development Plan that (a) are conducted by Alnylam, (b) are in excess of the then-applicable Development Costs Cap, and (c) are approved by the JSC (the "**Extra Early Development Costs**").

2.3.2 MedCo Development Plan. MedCo shall be responsible for all Development activities with respect to Licensed Products under the MedCo Development Plan and, as and to the extent mutually agreed by the Parties in writing, Alnylam will assist MedCo in such Development activities under the MedCo Development Plan. MedCo shall be responsible for one hundred percent (100%) of all costs and expenses with respect to such Development activities that are conducted by or on behalf of MedCo and, if agreed upon in writing by the Parties, all Costs with respect to such Development activities that are conducted by Alnylam after Phase I Completion pursuant to the MedCo Development Plan.

2.3.3 Development and Certain Supply Costs. Within thirty (30) days following the end of each Calendar Quarter in which Costs are incurred by Alnylam under the Initial Development Plan or the MedCo Development Plan or pursuant to Section 5.1(a), Alnylam shall prepare and deliver to MedCo a quarterly report summarizing such Costs incurred during such period. Alnylam shall submit any additional information reasonably requested by MedCo related to such Costs included in its report within [***] Business Days after its receipt of such request. Alnylam shall issue concurrently an invoice to MedCo for any Extra Early Development Costs incurred by Alnylam and/or any Costs incurred by Alnylam pursuant to the MedCo Development Plan in conducting activities to be conducted by Alnylam as agreed upon in writing by the Parties, and MedCo shall pay all amounts within [***] days after its receipt of the invoice. Alnylam and its Affiliates shall keep complete and accurate records in sufficient detail to enable the payments payable hereunder to be determined. Commencing after Alnylam first issues such an invoice, MedCo shall have the right to audit the records of Alnylam with respect to any such Costs included in such reports, in accordance with Section 7.5.

2.4 Diligence.

(a) After the JSC's selection of the Lead Product, MedCo will use Commercially Reasonable Efforts to (i) Develop at least one Licensed Product and obtain Regulatory Approval of at least one Licensed Product in each Major Market Country and (ii) subject to Section 2.3.2, perform the Development activities under the MedCo Development Plan.

(b) Alnylam will use Commercially Reasonable Efforts to perform the Development activities under the Initial Development Plan and, subject to Section 2.3.2, those activities under the MedCo Development Plan which Alnylam has agreed in writing to undertake; *provided*, *however*, that except as expressly provided in this Agreement or otherwise agreed to in writing by Alnylam, in no event will Alnylam be required to perform any activities under the Initial Development Plan or the MedCo Development Plan with respect to Licensed Products that would require Alnylam to incur Costs in excess of the then-applicable Development Costs Cap, unless paid or payable by MedCo as Extra Early Development Costs. Alnylam will be excused from its obligation to perform its affected Development and Manufacturing obligations with respect to Licensed Products under the Transaction Agreements during any period of time with respect to which Alnylam cannot perform such obligations to the extent that, (i) Alnylam becomes aware that the performance of such obligations would infringe Patent Rights that MedCo Controls and are reasonably necessary for such performance by Alnylam, and (ii) Alnylam is not protected by any safe harbor provisions with respect to claims that it would

infringe such Patent Rights. The Parties agree to promptly discuss in good faith a mutually agreed resolution to such a situation. If the Parties agree in writing that MedCo will grant Alnylam a license or sublicense under such Patent Rights, then unless otherwise agreed by the Parties in writing, such Patent Rights will be considered MedCo Patent Rights, and if such Patent Rights are licensed to MedCo or its Affiliate by a Third Party, such sublicense shall be subject to the relevant license agreement to MedCo or its Affiliate from such Third Party and such agreement shall be designated a MedCo In-License.

2.5 Records and Reports.

2.5.1 Prior to the date that is [***] days after Phase I Completion, Alnylam shall prepare and deliver to the JSC a quarterly written report summarizing Alnylam's Development activities for Licensed Products performed to date (or updating such report for activities performed since the last such report submitted hereunder, as applicable). Within [***] days after Phase I Completion Alnylam shall deliver to the JSC a final report of Alnylam's Development activities for the Licensed Products. After Phase I Completion, MedCo shall prepare and deliver to the JSC, by no later than each [***] (for the period ending December 31 of the prior Calendar Year), written reports summarizing Development activities for Licensed Products performed to date (or updating such report for activities performed since the last such report submitted hereunder, as applicable), with Alnylam providing to MedCo, in accordance with the MedCo Development Plan, written reports summarizing Alnylam's activities (if any) under the MedCo Development Plan. Each Party will provide the members of the JSC with written copies of all materials they intend to present at a JSC meeting. The JSC may also request at any time specific material data or information related to Collaboration activities or that a written report be prepared in advance of any meeting summarizing certain material data and information arising out of the conduct of the Collaboration activities, and the Party or appropriate committee to whom such request is made shall promptly provide to the other Party or JSC such report, data or information.

2.5.2 Each Party will maintain scientific records, in sufficient detail and in good scientific manner appropriate for patent and regulatory purposes, which will fully and properly reflect all work done and results achieved in the performance of the Development activities with respect to Licensed Products by such Party. Each Party will have the right, during normal business hours and upon reasonable notice, to inspect and copy (or request the other Party to copy) all records of the other Party maintained in connection with the work done and results achieved in the performance of such Development activities, but solely to the extent access to such records is necessary for such Party to exercise its rights under this Agreement. All such records, and the information disclosed therein, will be maintained as Confidential Information by the recipient Party in accordance with Article 8.

2.6 Regulatory Matters.

2.6.1 Regulatory Filings and Interactions. Alnylam shall be the "**Regulatory Lead**" with respect to Licensed Products through Phase I Completion and MedCo shall be the Regulatory Lead with respect to Licensed Products thereafter. Except as otherwise provided in the Initial Development Plan or Section 2.6.2, (a) each Party will own the INDs, the NDAs and related regulatory documents submitted to the applicable Regulatory Authorities by it with respect to Licensed Products and (b) the Regulatory Lead will, as to Licensed Products, (i) oversee, monitor and coordinate all regulatory actions, communications and filings with, and submissions to, each Regulatory Authority, (ii) be

responsible for interfacing, corresponding and meeting with each Regulatory Authority, and (iii) be responsible for maintaining all regulatory filings. Alnylam will promptly notify the JSC in writing of all material communications received by it from Regulatory Authorities regarding the Licensed Products and of all filings and submissions made by it to Regulatory Authorities regarding the Licensed Products; *provided*, *however*, that after Phase I Completion, Alnylam shall not communicate with any Regulatory Authority regarding any Licensed Product without MedCo's prior written consent, except as required by Law or as requested or required by a Regulatory Authority. MedCo shall provide Alnylam with written notice of (x) all filings and submissions for Regulatory Approval regarding any Licensed Product in the Territory in a timely manner; and (y) all Regulatory Approvals obtained or denied and the filing of any IND for any Licensed Product within fifteen (15) days after such event; *provided*, *however*, that in all circumstances except as required by Law, MedCo shall inform Alnylam of such event prior to public disclosure of such event by MedCo.

2.6.2 IND Transfer; Right of Reference. Upon MedCo's written request Alnylam will use Commercially Reasonable Efforts to promptly transfer to MedCo, at Alnylam's expense, Alnylam's IND for the Lead Product after Phase I Completion, and any other Alnylam Know-How reasonably requested by MedCo with respect to any such IND. During the Term, each Party will have the right to reference the other Party's INDs, NDAs and other filings with and submissions to Regulatory Authorities with respect to Licensed Products for the purpose of conducting its Development activities under the Initial Development Plan and the MedCo Development Plan, and in the case of MedCo, to otherwise obtain Regulatory Approval of Licensed Products in the Territory.

2.6.3 Pharmacovigilance. Within [***] months after the Effective Date, the Parties will develop and agree in writing upon a pharmacovigilance agreement ("**Pharmacovigilance Agreement**") that will include safety data exchange procedures governing the coordination of collection, investigation, reporting, and exchange of information concerning any adverse experiences, and any product quality and product complaints involving adverse experiences, related to Licensed Products, sufficient to enable each Party to comply with its legal and regulatory obligations.

2.7 Information Exchange. Prior to Phase I Completion, Alnylam shall provide, and shall have its Affiliates provide, to MedCo, without additional compensation, all material Know-How Controlled by Alnylam and/or its Related Parties (as applicable) relating to Licensed Products, including copies of (a) pre-clinical and clinical safety and efficacy data, (b) protocols and investigator brochures, and (c) regulatory filings, that are reasonably necessary or useful for MedCo (or its Related Parties) to perform its obligations or exploit its rights under this Agreement with respect to such Licensed Products. Promptly after Phase I Completion and on an ongoing basis throughout the Term, as requested by the JSC and to the extent not already provided to MedCo, Alnylam shall provide, and shall have its Affiliates provide, to MedCo, without additional compensation, all material Alnylam Know-How that relates to the Licensed Products, including copies of (i) pre-clinical and clinical safety and efficacy data, (ii) protocols and investigator brochures and (iii) regulatory filings, in each case that are reasonably necessary or useful for MedCo (or its Related Parties) to perform its obligations or exploit its rights under this Agreement with respect to such Licensed Products. The transfer of Alnylam Know-How reasonably necessary or useful for the Manufacture of Licensed Products by

Alnylam and its Affiliates to MedCo will also be subject to the provisions of Section 5.2 and the Development Supply Agreement.

2.8 **Third Parties**. The Parties shall be entitled to utilize the services of Third Party contract research and contract manufacturing organizations to perform their respective Development and Manufacturing activities under this Agreement; *provided*, that (a) each Party shall ensure that such Third Parties it utilizes operate in a manner consistent with the terms of this Agreement and (b) each Party shall remain at all times fully liable for its responsibilities under this Agreement. Each Party shall ensure that any agreements with such Third Parties shall include confidentiality and non-use provisions that are no less stringent than those set forth in Section 8.1 of this Agreement and shall use Commercially Reasonable Efforts to obtain ownership of, and/or a fully sublicenseable license under and to, any Know-How and Patent Rights that are developed or used by such Third Parties in the performance of such agreement and are reasonably necessary or useful to Develop, Manufacture and/or Commercialize Licensed Products in the Field.

3. COMMERCIALIZATION OF THE LICENSED PRODUCTS

3.1 **Responsibility and Diligence**. As between the Parties, MedCo shall have the sole right and be solely responsible, at its expense, for all Commercialization activities relating to Licensed Products in the Field in the Territory. MedCo shall use Commercially Reasonable Efforts, through itself or its Related Parties, to Commercialize at least one Licensed Product in the Field in at least each Major Market Country after receipt of Regulatory Approval of such Licensed Product in the Field in such Major Market Country.

3.2 **MedCo Commercialization Plan.** No less than [***] months in advance of the reasonably expected first Regulatory Approval in the Territory with respect to a Licensed Product, and on an annual basis thereafter, MedCo shall prepare and deliver to Alnylam, a written non-binding plan that summarizes the Commercialization activities to be undertaken with respect to Licensed Products in the Territory in the next Calendar Year and, to the extent commercially reasonable, MedCo's plans to obtain further Regulatory Approvals and Commercialize Licensed Products in countries in the Territory in which MedCo is not then Commercializing Licensed Products, and the dates by which such activities are targeted to be accomplished (the "**MedCo Commercialization Plan**"). The MedCo Commercialization Plan shall subsequently be updated and modified by MedCo, from time to time and no less frequently than once per Calendar Year.

3.3 **Advertising and Promotional Materials**. MedCo will be responsible for the creation, preparation, production, reproduction and filing with the applicable Regulatory Authorities, of relevant written sales, promotion and advertising materials relating to Licensed Products for use in the Territory. All such promotional materials will be compliant with all Laws, and substantially consistent with the MedCo Commercialization Plan. To the extent permitted by Law, MedCo and its Related Parties shall use Commercially Reasonable Efforts to include Alnylam's (or its designee's) name with reasonable prominence on Licensed Product promotional materials related to the Licensed Product in the Territory in acknowledgement of Alnylam's contributions to the Licensed Product.

3.4 Reporting Obligations. MedCo shall prepare and deliver to Alnylam, by no later than each [***] following the first Regulatory Approval of a Licensed Product in the Field in the Territory (for the period ending December 31 of the prior Calendar Year), written reports summarizing MedCo's Commercialization activities for Licensed Products performed to date (or updating such report for activities performed since the last such report submitted hereunder, as applicable). In addition, MedCo shall provide Alnylam with written notice of the First Commercial Sale of each Licensed Product in the Territory within [***] days after such event; *provided*, *however*, that in all circumstances except as required by Law, MedCo shall inform Alnylam of such event prior to public disclosure of such event by MedCo. MedCo shall also provide such other information to Alnylam as Alnylam may reasonably request with respect to MedCo's Commercialization activities with respect to Licensed Products.

3.5 Sales and Distribution. MedCo and its Related Parties shall have the sole right and shall be responsible for the pricing of Licensed Products, booking sales, warehousing and distribution of Licensed Products in the Territory. Moreover, MedCo and its Related Parties shall have the sole right and shall be solely responsible for handling all returns of commercialized Licensed Product, as well as all aspects of Licensed Product order processing, invoicing and collection, distribution, inventory and receivables, in the Territory.

3.6 Recalls, Market Withdrawals or Corrective Actions. In the event that any Regulatory Authority issues or requests a recall or takes a similar action in connection with the Licensed Product in the Territory, or in the event MedCo determines that an event, incident or circumstance has occurred that may result in the need for a recall or market withdrawal in the Territory, MedCo shall, within [***] hours after it receives such information from such Regulatory Authority or makes such determination, advise Alnylam thereof by telephone, facsimile or e-mail.

3.7 Commercialization Expenses. As between the Parties, MedCo shall bear all costs and expenses incurred in connection with the Commercialization of Licensed Products in the Territory.

4. COLLABORATION MANAGEMENT

4.1 Joint Steering Committee. The Parties hereby establish a joint steering committee (the "**JSC**") to facilitate the Collaboration as follows:

4.1.1 Composition of the Joint Steering Committee. The Development of Licensed Products hereunder shall be conducted under the direction of the JSC, which shall comprise [***] representatives of MedCo and [***] representatives of Alnylam. Each Party shall appoint its respective representatives to the JSC from time to time, and may substitute one or more of its representatives, in its sole discretion, effective upon notice to the other Party of such change. Each Party shall have at least one JSC representative who is a senior employee (vice president level or above), and all JSC representatives shall be employees of the relevant Party and have appropriate expertise and ongoing familiarity with the Collaboration. Additional non-voting representatives or consultants may from time to time, by mutual consent of the Parties, be invited to attend JSC meetings, subject to all representatives (including the designated voting representatives) and consultants undertaking confidentiality obligations in a written agreement (which may have been executed prior to the Effective Date) that are substantially comparable to the requirements of Section 8.1. All

proceedings for the JSC shall take place in English. Each Party shall bear its own expenses relating to attendance at such meetings by its representatives.

4.1.2 JSC Chairperson. The JSC chairperson shall be an employee of Alnylam prior to Phase I Completion and an employee of MedCo thereafter. The JSC chairperson's responsibilities shall include (a) scheduling meetings at least once per Calendar Quarter, but more frequently if the JSC determines it necessary; (b) setting agendas for meetings with solicited input from other members; (c) coordinating the delivery of draft minutes to the JSC for review and final approval; and (d) conducting meetings, including ensuring that objectives for each meeting are set and achieved. The JSC chairperson shall have no greater authority on the JSC than any other representative of the JSC.

4.1.3 JSC Responsibilities. The JSC shall have the following responsibilities with respect to the Collaboration:

(a) reviewing reports and updates provided by Alnylam regarding the Development of Licensed Products under the Initial Development Plan, including material modifications and updates to the Initial Development Plan provided by Alnylam in accordance with Section 2.2.1, providing Alnylam with feedback regarding same and approving such updates and modifications to the Initial Development Plan in accordance with Section 2.2.1;

(b) [***];

(c) approving Extra Early Development Costs in accordance with Section 2.3.1(c);

(d) reviewing reports and updates provided by MedCo regarding the Development of Licensed Products in the Territory, including reviewing and approving the MedCo Development Plan and updates thereto in accordance with Section 2.2.3;

(e) ensuring coordination between the Parties with respect to Development activities in the Territory for Licensed Products under the MedCo Development Plan (to the extent the Parties have agreed in writing that Alnylam should perform any such activities), and regulatory and pharmacovigilance requirements and matters to the extent necessary for the Parties to perform their duties or exercise their rights hereunder and for the Parties to comply with the Pharmacovigilance Agreement and the requirements of Law and Regulatory Authorities, respectively;

(f) regularly assessing the progress of Alnylam in its conduct of the Initial Development Plan and the progress of MedCo in its conduct of the MedCo Development Plan, against the respective timelines contained therein;

(g) reviewing Alnylam Technology that would be reasonably helpful to MedCo's Development of Licensed Products and determine which of such Alnylam Technology should be transferred to MedCo; and

(h) performing such other activities as the Parties agree in writing shall be the responsibility of the JSC.

For purposes of clarity, the JSC shall not have the authority to modify the terms of this Agreement.

4.1.4 Meetings. The first JSC meeting shall be held within [***] months after the Effective Date, and the JSC shall thereafter meet in accordance with a schedule established by mutual written agreement of the Parties, but no less frequently than [***] per Calendar Quarter, with the location for such meetings alternating between Alnylam's and MedCo's US facilities (or such other locations as are mutually agreed by the Parties). Alternatively, the JSC may meet by means of teleconference, videoconference or other similar communications equipment, but at least [***] meetings per Calendar Year shall be conducted in person.

4.2 Appointment of Subcommittees, Project Teams and Collaboration Managers. The JSC shall be empowered to create such subcommittees of itself and project teams as it may deem appropriate or necessary. Each such subcommittee and project team shall report to the JSC, which shall have authority to approve or reject recommendations or actions proposed thereby subject to the terms of this Agreement. The provisions of Sections 4.1.1 and 4.1.4 shall apply to each subcommittee, *mutatis mutandis*, unless otherwise determined by the JSC.

4.3 Minutes. A secretary shall be appointed for each meeting and shall prepare minutes of the meeting, which shall provide a description in reasonable detail of the discussions held at the meeting and a list of any actions, decisions or determinations approved by the JSC. The JSC secretary shall have no greater authority on the JSC than any other representative of the JSC.

4.4 Decision-Making.

4.4.1 With respect to decisions of the JSC, the representatives of each Party shall have collectively one vote on behalf of such Party. For each meeting of the JSC, at least one (1) representative of each Party shall constitute a quorum and each Party shall use Commercially Reasonable Efforts to have its representative(s) participate in each JSC meeting. Action on any matter may be taken at a meeting, by teleconference, videoconference or by written agreement. The JSC shall attempt to resolve any and all disputes before it for decision by consensus.

4.4.2 If the JSC is unable to reach a consensus with respect to a dispute for a period in excess of [***] days, then the dispute shall be submitted to the Chief Executive Officers of Alnylam and MedCo for resolution.

4.4.3 If such escalated dispute cannot be resolved for a period in excess of [***] days, then:

(a) [***]; and

(b) [***].

4.4.4 Notwithstanding the foregoing, MedCo may not exercise its final decision-making authority (i) to require Alnylam to undertake obligations beyond those for which it is responsible, or forgo any rights, under this Agreement, (ii) to cause Alnylam to incur any Costs above the then-applicable Development Costs Cap with respect to which MedCo has not otherwise agreed to

reimburse Alnylam under this Agreement, (iii) to require Alnylam to take or decline to take any action that would result in a violation of any Law or any agreement with any Third Party or the infringement of intellectual property rights of Third Parties, (iv) in a manner that excuses MedCo from any of its obligations specifically enumerated under this Agreement, or (v) to expand or narrow the responsibilities of the JSC.

4.5 Dissolution of JSC. The JSC shall be dissolved upon the First Commercial Sale of the last Licensed Product that is expected to be Developed in the Territory; *provided*, that after the fifth (5th) anniversary of the Effective Date Alnylam shall have the right, but not the obligation, to dissolve the JSC. Upon the dissolution of the JSC, MedCo shall have the sole rights and authority to take any action that had been within the JSC's purview.

5. MANUFACTURE AND SUPPLY OF THE LICENSED PRODUCT

5.1 Responsibilities for Licensed Product Supply.

(a) Alnylam will be solely responsible for (i) obtaining supply of Finished Product reasonably required for the conduct of Alnylam's obligations under the Initial Development Plan through Phase I Completion, and (ii) supplying MedCo with the quantity of Finished Product reasonably required for the first Phase II Study of the Lead Product conducted under the MedCo Development Plan (which, for clarity, may be the Phase II Study portion of a Phase I/II Study of the Lead Product initiated pursuant to the Initial Development Plan), in each case at Alnylam's expense for the Costs of such Licensed Product, but only to the extent that such Costs, when added to the Development Costs incurred by Alnylam pursuant to the Initial Development Plan, do not exceed the then-applicable Development Costs Cap, unless paid or payable by MedCo as Extra Early Development Costs.

(b) MedCo will have the sole right and responsibility to Manufacture and supply Licensed Product for Development and Commercialization in the Territory under the MedCo Development Plan (except that Alnylam shall be responsible for supplying Licensed Product as described in clause (a)(ii) above), subject to the successful completion of the transfer of Alnylam Know-How to MedCo or its designated Third Party(ies) contract manufacturers pursuant to Section 5.3 and the Development Supply Agreement.

5.2 Development Supply Agreement. Within [***] months after the Effective Date, the Parties will negotiate in good faith and enter into a supply and technical transfer agreement (the "**Development Supply Agreement**") pursuant to which Alnylam will (a) subject to the terms of Section 5.3, promptly provide MedCo or Third Party contract manufacturer(s) selected by MedCo and reasonably acceptable to Alnylam with Alnylam Know-How reasonably necessary or useful for the Manufacture of the Bulk Drug Substance, Bulk Drug Product and Finished Product, as the case may be, and shall make available its personnel on a reasonable basis to consult with MedCo with respect thereto, all at MedCo's expense for the Costs reasonably incurred by Alnylam in connection with such technology transfer activities; and (b) supply Finished Product to MedCo as set forth in Section 5.1(a)(ii). The terms and conditions of the Development Supply Agreement shall be commercially

reasonable and consistent with industry standards, as well as, if applicable, Alnylam's agreements with its Third Party contract manufacturers.

5.3 **Technology Transfer**. Subject to the terms of the Development Supply Agreement, as soon as reasonably practicable, but in no event later than the fifth (5th) anniversary of the Effective Date, Alnylam shall initiate a technology transfer to MedCo, or to its Third Party manufacturer(s) of Licensed Product, selected by MedCo and reasonably acceptable to Alnylam, of Alnylam Know-How that is reasonably necessary or useful for the Manufacture of the Licensed Product, and shall make available its personnel on a reasonable basis to consult with MedCo or such Third Party manufacturer(s) with respect thereto, all at MedCo's expense, including the Costs reasonably incurred by Alnylam in connection with such technology transfer activities. MedCo shall reimburse Alnylam such Costs incurred with respect to such Manufacturing technology transfer within [***] days after receipt of an invoice therefor. Alnylam and its Affiliates shall keep complete and accurate records in sufficient detail to enable the payments payable hereunder to be determined. Alnylam shall not be required to perform technology transfer to more than one Third Party manufacturer for each stage of the Licensed Product supply chain (i.e., Bulk Drug Substance, Bulk Drug Product and Finished Product). Promptly after MedCo's written request, Alnylam shall use Commercially Reasonable Efforts to assign to MedCo any manufacturing agreement between Alnylam and a Third Party that is solely related to the manufacture of Licensed Products. Such assignment shall be subject to the terms and conditions of such agreement, including any required consents of such Third Party and MedCo's written agreement to assume all the obligations of Alnylam under such agreement to be undertaken after such assignment, but Alnylam shall remain solely responsible for its obligations under such agreement arising prior to such assignment. Except as provided in the immediately preceding sentence, MedCo shall be solely responsible for contracting with such Third Party manufacturer (and any other Third Party manufacture to whom Alnylam has initiated technology transfer as set forth in this Section 5.3) for the supply of such Licensed Product and Alnylam shall have no obligations under such agreement between MedCo and such Third Party manufacturer. Alnylam shall use Commercially Reasonable Efforts to obtain any such consent in a form reasonably acceptable to MedCo.

5.4 **Additional Licensed Product Supply**. MedCo agrees to consider, and the Parties agree to discuss in good faith, the manufacture and supply of Bulk Drug Substance, Bulk Drug Product and/or Finished Product by Alnylam (or its designee) to MedCo for MedCo's further Development activities and/or for Commercial sale in the Territory; *provided*, *however*, that nothing in the foregoing sentence shall be construed to require the Parties to agree to such an arrangement.

6. LICENSES

6.1 License Grants to MedCo.

6.1.1 **Development and Commercialization License**. Subject to the terms and conditions of this Agreement, including Section 6.1.4, Alnylam hereby grants MedCo a non-transferable (except as provided in Section 13.1), sublicenseable (subject to Section 6.1.3), exclusive license under Alnylam Technology to Develop and Commercialize Licensed Products in the Field in the Territory. Such license shall be royalty-bearing for the Royalty Term applicable to each Licensed Product in each

country in the Territory, and, after the expiration of the Royalty Term applicable to such Licensed Product in such country, shall convert to a fully paid-up, irrevocable, perpetual, non-exclusive, sublicenseable (subject to Section 6.1.3) license to Develop and Commercialize such Licensed Product in the Field in such country.

6.1.2 Manufacturing License. Subject to the terms and conditions of this Agreement, including those set forth in Article 5 and Section 6.1.4, Alnylam hereby grants MedCo a non-transferable (except as provided in Section 13.1), sublicenseable (subject to Section 6.1.3), worldwide, royalty-bearing, exclusive license under Alnylam Technology to Manufacture Licensed Products for Development of Licensed Products after Phase I Completion and for Commercialization in the Field in the Territory. Such license shall be royalty-bearing for the Royalty Term applicable to each Licensed Product in each country in the Territory, and, after the expiration of the Royalty Term applicable to such Licensed Product in such country, shall convert to a fully paid-up, irrevocable, perpetual, non-exclusive, sublicenseable (subject to Section 6.1.3) license to Manufacture such Licensed Product for Development of Licensed Products after Phase I Completion and for Commercialization in the Field in such country.

6.1.3 Sublicensing Terms.

(a) MedCo shall have the right to sublicense any of its rights under Section 6.1.1 and 6.1.2 to any of its Affiliates or to any Third Party without the prior written consent of Alnylam, subject to the requirements of this Section 6.1.3, except that Alnylam's prior written consent shall be required for any sublicense to a Third Party of either (i) all or substantially all of MedCo's rights under this Agreement, or (ii) all or substantially all of MedCo's rights to Develop and Commercialize Licensed Products in the United States.

(b) Each sublicense granted by MedCo pursuant to this Section 6.1.3 shall be subject to the terms and conditions of this Agreement and shall contain terms and conditions consistent with those in this Agreement. MedCo shall promptly provide Alnylam with a copy of the fully executed sublicense agreement covering any Commercialization sublicense granted hereunder, and each such sublicense agreement shall contain the following provisions: (i) a requirement that the Sublicensee comply with confidentiality and non-use provisions that are no less stringent than Section 8.1 with respect to Alnylam's Confidential Information; *provided, however*, that if such sublicense agreement contains a sublicense of Licensed Product sales rights, such sublicense agreement shall also contain the following provisions: (x) a requirement that the Sublicensee submit applicable sales or other reports to MedCo to the extent necessary or relevant to the reports required to be made or records required to be maintained under this Agreement; and (y) the audit requirement set forth in Section 7.5; and (ii) subject to Section 6.4, any other provisions applicable to a Sublicensee required under any Alnylam In-License or necessary to allow Alnylam or its Affiliates to comply with its obligations thereunder, to the extent that MedCo had been made aware of such provisions prior to entering into such sublicense, including any such provision regarding diligence, insurance, indemnification, confidentiality, reporting, audits, publication, data sharing or regulatory matters.

(c) If MedCo becomes aware of a material breach of any sublicense by a Sublicensee of the rights granted to MedCo under this Section 6.1, MedCo shall promptly notify Alnylam of the particulars of the same and use Commercially Reasonable Efforts to cause the Sublicensee to comply with all the terms of the sublicense necessary for MedCo's compliance with the terms of this Agreement. In the event that (i) the Sublicensee has failed to cure a material breach of such obligations within [***] days after notice of such breach and (ii) such material breach also constitutes a breach of this Agreement, MedCo shall terminate the sublicense at the request of Alnylam; *provided*, *however*, that, if such Sublicensee disputes that it has materially breached such obligations, or disputes that it has not timely cured a breach of such obligations, MedCo shall not be obligated to terminate such sublicense until such dispute is resolved by settlement, or in a final, non-appealable decision of a court or arbitrator, finding that such Sublicensee had materially breached such sublicense and had not timely cured such material breach. Notwithstanding any sublicense, MedCo shall remain primarily liable to Alnylam for the performance of all of MedCo's obligations under, and MedCo's compliance with all terms and conditions of, this Agreement.

6.1.4 Retained Rights. Notwithstanding the license grants in Sections 6.1.1 and 6.1.2, Alnylam retains the rights under Alnylam Technology (a) to Develop and Manufacture Licensed Products in the Field in the Territory solely for the purpose and only to the extent necessary for the performance of its obligations under the Transaction Agreements, and (b) for all internal basic and preclinical research purposes, in each case including the right to collaborate with and issue sublicenses to academic collaborators and/or Third Party contractors involved in such research activities.

6.2 License Grants to Alnylam.

6.2.1 Development and Manufacturing License. Subject to the terms and conditions of this Agreement, MedCo hereby grants Alnylam a non-transferable (except as provided in Section 13.1), sublicenseable (subject to Section 6.2.3), non-exclusive, worldwide, royalty-free license, under MedCo Technology, to perform Alnylam's Development and Manufacturing obligations with respect to Licensed Products under the Transaction Agreements.

6.2.2 MedCo Improvements License. Subject to the terms and conditions of this Agreement, MedCo hereby grants Alnylam a non-transferable (except as provided in Section 13.1), sublicenseable (subject to Section 6.2.3), worldwide, non-exclusive, royalty-free license under any MedCo Improvements to research, develop, manufacture and/or commercialize products containing siRNA molecules in the Field and in the Territory. Such license is subject to the exclusive license grants to MedCo under Section 6.1 and the terms of Section 9.5.1.

6.2.3 Sublicensing Terms.

(a) Alnylam shall have the right to sublicense any of its rights under Section 6.2.1 to any of its Affiliates or to any Third Party contractor without the prior written consent of MedCo, subject to the requirements of this Section 6.2.3. Alnylam shall have the right to sublicense any of its rights under Section 6.2.2 or Section 12.3(b) to any of its Affiliates or to any Third Party without the prior written consent of MedCo, subject to the requirements of this Section 6.2.3.

(b) Each sublicense granted by Alnylam pursuant to this Section 6.2.3 shall be subject to the terms and conditions of this Agreement and shall contain terms and conditions consistent with those in this Agreement. Each such sublicense agreement shall contain the following provisions: (i) a requirement that the Sublicensee comply with confidentiality and non-use provisions that are no less stringent than Section 8.1 with respect to MedCo's Confidential Information, and (ii) subject to Section 6.4, any other provisions applicable to a Sublicensee required under any MedCo In-License or necessary to allow MedCo or its Affiliates to comply with its obligations thereunder, to the extent that Alnylam had been made aware of such provisions prior to entering into such sublicense, including any such provision regarding diligence, insurance, indemnification, confidentiality, reporting, audits, publication, data sharing or regulatory matters.

(c) If Alnylam becomes aware of a material breach of any sublicense by a Sublicensee of the rights granted to Alnylam under this Section 6.2 or Section 12.3(b), Alnylam shall promptly notify MedCo of the particulars of the same and use Commercially Reasonable Efforts to cause the Sublicensee comply with all the terms of the sublicense necessary for Alnylam's compliance with the terms of this Agreement. In the event that (i) the Sublicensee has failed to cure a material breach of such obligations within [***] days after notice of such breach and (ii) such material breach also constitutes a breach of this Agreement, Alnylam shall terminate the sublicense at the request of MedCo; *provided*, *however*, that, if such Sublicensee disputes that it has materially breached such obligations, or disputes that it has not timely cured a breach of such obligations, Alnylam shall not be obligated to terminate such sublicense until such dispute is resolved by settlement, or in a final, non-appealable decision of a court or arbitrator, finding that such Sublicensee had materially breached such sublicense and had not timely cured such material breach. Notwithstanding any sublicense, Alnylam shall remain primarily liable to MedCo for the performance of all of Alnylam's obligations under, and Alnylam's compliance with all terms and conditions of, this Agreement.

6.3 Joint Collaboration IP. Subject to the rights and licenses granted to, and the obligations of, each Party under this Agreement, including MedCo's obligations under Section 7.4 during the Term, each Party shall have the right to exploit its interest in Joint Collaboration IP without the consent of and without accounting to the other Party.

6.4 In-Licenses and Existing Alnylam Third Party Agreements.

6.4.1 Compliance with In-Licenses.

6.4.1.1 All licenses and other rights granted to MedCo under this Article 6 (including any sublicense rights) are subject to the rights and obligations of Alnylam and its Affiliates under the Alnylam In-Licenses and the Existing Alnylam Third Party Agreements. All licenses and other rights granted to Alnylam under this Article 6 and Section 12.3(b) (including any sublicense rights) are subject to the rights and obligations of MedCo and its Affiliates under the MedCo In-Licenses.

6.4.1.2 Subject to Section 6.4.1.3, (a) each Party (the "**Sublicensed Party**") granted a sublicense under any of the In-Licenses of the other Party (the "**Sublicensor Party**") shall comply with all applicable terms and conditions of the In-Licenses of the Sublicensor Party to

the extent (i) required by the terms of such In-Licenses with respect to a sublicense under the terms of such In-License to the extent applicable to (A) the Sublicensed Party's rights or obligations relating to the Development, Manufacture or Commercialization of Licensed Products under any of the Transaction Agreements or (B) the filing, prosecution, maintenance, extension, defense, enforcement, patent challenge or the further sublicensing of the Alnylam Technology (if Alnylam is the Sublicensor Party) or the MedCo Technology (if MedCo is the Sublicensor Party) to the extent relevant to the Sublicensed Party's rights or obligations relating to the Development, Manufacture or Commercialization of Licensed Products under any of the Transaction Agreements, and (ii) the Sublicensed Party has been given written notice or provided a copy of such provisions on or prior to the later of (x) the Effective Date or (y) the date on which such In-License is first required to have been provided to the Sublicensed Party hereunder (*provided* that, with respect to an amendment thereto, such amendment is consistent with the last sentence of Section 6.4.4), and (b) each Sublicensed Party shall perform and take such actions as may be required to allow the Sublicensor Party to comply with its obligations under the Sublicensor Party's In-Licenses, to the extent (i) applicable to (A) the Sublicensed Party's rights or obligations relating to the Development, Manufacture or Commercialization of Licensed Products under any of the Transaction Agreements or (B) the filing, prosecution, maintenance, extension, defense, enforcement, patent challenge or the further sublicensing of the Alnylam Technology (if Alnylam is the Sublicensor Party) or the MedCo Technology (if MedCo is the Sublicensor Party) to the extent relevant to the Sublicensed Party's rights or obligations relating to the Development, Manufacture or Commercialization of Licensed Products under any of the Transaction Agreements and (ii) that the Sublicensed Party had been given written notice or provided a copy of such provisions on or prior to the later of (x) the Effective Date or (y) the date on which such In-License is first required to have been provided to the Sublicensed Party hereunder (*provided* that, with respect to an amendment thereto, such amendment is consistent with the last sentence of Section 6.4.4), including any such obligations relating to sublicensing, patent matters, confidentiality, reporting, audit rights, indemnification and diligence. Without limiting the foregoing, each Sublicensed Party shall prepare and deliver to the Sublicensor Party any additional reports required under the applicable In-Licenses of the Sublicensor Party, in each case reasonably sufficiently in advance to enable the Sublicensor Party to comply with its obligations under the applicable In-Licenses, to the extent that the Sublicensed Party had been made aware of such provisions with reasonably sufficient time prior to the date on which such compliance is required in order for such Sublicensed Party, or its Related Parties, to properly prepare such reports, using Commercially Reasonable Efforts, including reasonably sufficient time to gather, analyze, format and review the relevant information (to the extent not already required to be provided to the Sublicensor Party under any Transaction Agreement other than pursuant to an In-License Agreement of the Sublicensor Party).

6.4.1.3 The Parties acknowledge that the terms of any In-License may be subject to interpretation. The Parties shall cooperate with each other in good faith to support each Sublicensed Party in complying with its obligations, in accordance with this Section 6.4, under an In-License pursuant to which such Sublicensed Party has been granted a sublicense pursuant to this Agreement. Without limitation to the foregoing, the Parties shall, from time to time,

upon the reasonable request of either Party, discuss the terms of any In-License and agree upon, to the extent reasonably possible, a consistent interpretation of the terms of such In-License in order to, as fully as possible without imposing an unreasonable burden on the normal business activities of any Party, allow the Sublicensor Party and the Sublicensed Party to comply with the terms of such In-License, without imposing an unreasonably higher burden on one Party than the other with respect to compliance with the terms of such In-License. Promptly after a Party reaches a conclusion or obtains information that such interpretation is or may be incorrect, it shall share such conclusion or information with the other Party and the Parties shall discuss such conclusion or information.

6.4.1.4 Each Sublicensor Party shall ensure that, to the fullest extent permitted under the relevant In-License, any Confidential Information of the Sublicensed Party disclosed to the relevant Third Party as required by such In-License shall be protected as confidential information of the Sublicensor Party in accordance with such In-License.

6.4.1.5 Each Sublicensor Party agrees, upon the Sublicensed Party's request, to provide the Sublicensed Party with copies of any In-Licenses to which the Sublicensed Party is a party (other than any amendments or side letters thereto which are not materially relevant to the rights granted to, and the obligations imposed on, the Sublicensed Party under this Agreement). Each Sublicensor Party shall promptly provide the Sublicensed Party with a copy of any amendment, including any side letter, to any In-License of the Sublicensor Party, to the extent relevant in any way to the rights or obligations of the Sublicensed Party and whether or not such amendment is consistent with the obligations of the Sublicensor Party under the last sentence of Section 6.4.4. Confidential Information of the Sublicensor Party or its counterparty may be redacted from such copies, except to the extent that such information is required in order to enable the Sublicensed Party to comply with its obligations to the Sublicensor Party under this Agreement with respect to such In-License or in order to enable the Sublicensor Party to ascertain compliance with the provisions of this Agreement.

6.4.1.6 If the Sublicensor Party receives written notice from the relevant Third Party that the Sublicensor Party is in material breach of its In-License such that it would materially adversely affect the rights of the Sublicensed Party under this Agreement, and if the Sublicensor Party determines that it cannot or chooses not to cure or otherwise resolve any such alleged breach or default, then the Sublicensor Party shall so notify the Sublicensed Party within ten (10) Business Days of such determination.

6.4.1.7 To the extent that the Sublicensor Party receives written notice from the relevant Third Party that the Sublicensed Party is in material breach of an obligation imposed on the Sublicensed Party under an In-License of the Sublicensor Party pursuant to this Section 6.4, the Sublicensor Party shall promptly provide the Sublicensed Party with a copy of such breach notice, and any other relevant documents, received from such Third Party, but in no event more than five (5) Business Days after the Sublicensor Party's receipt thereof.

6.4.2 New In-Licenses; Additional Alnylam In-Licenses.

6.4.2.1 Alnylam Negotiation of Future Alnylam In-Licenses. Subject to Section 6.4.2.4, in the event that Alnylam or its Affiliate determines to enter into an agreement with a Third Party after the Effective Date pursuant to which Alnylam or its Affiliate would acquire a license under Patent Right(s) that Covers the development, manufacture or commercialization of pharmaceutical products comprised of siRNA compositions (other than microRNAs, microRNA antagonists or MicroRNA Mimics) in the Field and the Territory, and if such a license with respect to Licensed Products in the Field is available, then Alnylam shall use best efforts to ensure that the terms of such license applicable to Licensed Products in the Field are not materially less favorable than the terms applicable to other pharmaceutical products containing siRNA compositions in the Field under such license agreement.

6.4.2.2 Acceptance of Future Alnylam In-Licenses. In the event that Alnylam (the **"Licensing Party"**) or its Affiliate enters into an agreement with a Third Party after the Effective Date that meets the criteria set forth in clause (b) of the definition of Alnylam In-License, then Alnylam will promptly provide MedCo with notice and a copy of the applicable Third Party agreement. Within thirty (30) days following receipt of such notice, MedCo will decide, in its sole discretion, whether to accept the applicable Third Party agreement as an Alnylam In-License, and provide notice of such decision to Alnylam. In the event that MedCo declines to accept such agreement as an Alnylam In-License, any rights granted to MedCo thereunder will not be deemed to be "Controlled" by Alnylam or licensed to MedCo under this Agreement, and will not be subject to the payment provisions under this Agreement relating to In-Licenses. In the event that MedCo accepts such Third Party agreement as an Alnylam In-License, such agreement will thereafter be included within the definition of Alnylam In-License, and any rights granted to Alnylam thereunder will be deemed to be "Controlled" by Alnylam and sublicensed to MedCo pursuant to the terms of this Agreement.

6.4.2.3 Additional Alnylam In-Licenses. MedCo shall have the option, exercisable during the Term upon written notice to Alnylam, and on an Additional Alnylam In-License by Additional Alnylam In-License basis, to expand the definition of Alnylam Patent Rights under this Agreement to include the Patent Rights Controlled by Alnylam under such Additional Alnylam In-License. Upon receipt of such written notice from MedCo, then such agreement will thereafter be included within the definition of Existing Alnylam In-Licenses, and all rights granted to Alnylam thereunder will be deemed to be "Controlled" by Alnylam and sublicensed to MedCo under this Agreement effective as of the date of such written notice, and Schedule D will be updated accordingly.

6.4.2.4 Product-Specific Rights. As between the Parties, MedCo and its Affiliates shall have the sole right to enter into an agreement with a Third Party after the Effective Date to acquire a license with respect to Licensed Products in the Field under any Patent Right that (a) Covers the Development, Manufacture or Commercialization of any Licensed Product and (b) if such license had been acquired by Alnylam, would be an Alnylam Product-Specific Patent Right.

6.4.3 Payments Under In-Licenses.

6.4.3.1 Alnylam shall bear [***] percent ([***]%) of any Third Party License Payments under the Alnylam In-Licenses, other than the payments described in Section 6.4.3.2, that become payable based on the licensing or sublicensing to MedCo of rights thereunder, or the exercise by MedCo of rights hereunder, with respect to Licensed Products.

6.4.3.2 Subject to Sections 6.1.3(a), and 7.4.5 (to the extent applicable), MedCo shall bear [***] percent ([***]%) of, and shall reimburse Alnylam for:

(a) [***], and, if MedCo exercises its option pursuant to Section 6.4.2.3 with respect to [***], under the [***], that become payable based on the Manufacture or Commercialization by MedCo or its Related Parties of Licensed Products; *provided*, *however*, that (i) such [***], as the case may be, shall not [***] as set forth as of the Effective Date in such [***], as applicable, and (ii) the [***] taken together shall not exceed (x) with respect to [***], (A) on or prior to [***], and (B) after [***] (as defined on Schedule D), [***] (as defined on Schedule D) and, [***], which cover [***], [***]; and (y) with respect to [***], (A) on or prior to [***], and (B) after [***], which cover [***],

(b) [***], other than the [***], that become payable based on the Manufacture or Commercialization by MedCo or its Related Parties of Licensed Products [***]; *provided*, *however*, that the [***] under each [***] shall not [***] as set forth as of the Effective Date in such [***],

(c) [***], other than the [***], that become payable based on the Development, Manufacturing or Commercialization by MedCo or its Related Parties of Licensed Products, not to exceed [***] provided by Alnylam to MedCo pursuant to Section 6.4.2.2, and

(d) [***] that become payable based on [***] thereunder, or [***] hereunder, with respect to Licensed Products.

6.4.3.3 With respect to the calculation of royalties payable by MedCo pursuant to Section 6.4.3.2(a), (b) or (c), if any such royalties are calculated based on the total sales during any relevant period of any Licensed Product(s) and any other products which are not Licensed Products, then the royalties shall be allocated pro rata to such Licensed Product(s) and other products such that MedCo, on the one hand, and Alnylam and its Affiliates and other licensees, on the other hand, bear their pro rata portion of such royalties based on the total sales of such Licensed Product(s) and such other products during the relevant time period. Subject to the confidentiality and non-use obligations of Article 8, the Parties shall share any reasonably necessary information in order to properly calculate the royalty payments due from MedCo in accordance with this Section 6.4.3.3 and any overpayment by MedCo hereunder shall be

promptly refunded to MedCo. Schedule H provides a non-limiting example of the calculations with respect to this Section 6.4.3.3.

6.4.3.4 With respect to any milestone payments payable by MedCo pursuant to Section 6.4.3.2(c), if any such milestone payments are due only on the first product to achieve the relevant milestone event under the relevant Alnylam In-License, and a Licensed Product is the first such product, then, upon the achievement of such milestone event by each of the next two (2) products which are not Licensed Products to achieve such milestone event, Alnylam shall pay to MedCo [***] of the milestone payment paid by MedCo with respect to such milestone event. If a Licensed Product is not the first product to achieve the relevant milestone event, but is the second or third product to achieve the relevant milestone event, then MedCo agrees to reimburse Alnylam for [***] of such milestone payment.

6.4.3.5 Alnylam shall invoice MedCo for amounts payable by MedCo pursuant to Sections 6.4.3.2 and 6.4.3.4, and MedCo shall pay all such amounts to Alnylam within thirty (30) days after its receipt of the invoice. Alnylam and its Affiliates and sublicensees shall keep complete and accurate records in sufficient detail to enable the calculation of royalty payments by MedCo in accordance with Section 6.4.3.3, and the payments to or from MedCo pursuant to Section 6.4.3.4, to be determined. MedCo shall have the right to audit such records of Alnylam in accordance with Section 7.5.

6.4.4 Maintenance of In-Licenses. Each Sublicensor Party and its Affiliates shall use its Commercially Reasonable Efforts to maintain its good standing under each of its In-Licenses (including by not initiating any patent challenges which could result in the termination of any such In-License in accordance with its terms and promptly forwarding to the relevant Third Party all reports, payments and other information and material provided by the Sublicensed Party to the Sublicensor Party which, in accordance with the terms of such In-License, are to be forwarded or paid to the relevant Third Party). Without the prior written consent of the Sublicensed Party, neither Sublicensor Party nor its Affiliates shall (a) breach any of its material obligations or waive any of its rights under any of its In-Licenses, (b) amend any of its In-Licenses in any manner that would be materially adverse to the rights granted to the Sublicensed Party under this Agreement, or (c) terminate any of its In-Licenses, including by failure to satisfy any of its diligence obligations thereunder.

6.5 Bankruptcy. All rights and licenses granted under or pursuant to this Agreement by a Party to the other, including those set forth in Sections 6.1 and 6.2, are and shall otherwise be deemed to be, for purposes of Section 365(n) of the U.S. Bankruptcy Code, licenses of right to "intellectual property" as defined under Section 101 of the U.S. Bankruptcy Code. The Parties agree that the Parties and their respective Related Parties, as sublicensees of such rights under this Agreement, shall retain and may fully exercise all of their rights and elections under the U.S. Bankruptcy Code and any foreign counterpart thereto. The Parties further agree that that upon commencement of a bankruptcy proceeding by or against a Party (the "**Bankrupt Party**") under the Bankruptcy Code, the other Party (the "**Non-Bankrupt Party**") will be entitled to a complete duplicate of, or complete access to (as the Non-Bankrupt Party deems appropriate), all such intellectual property and all embodiments of such intellectual property. Such intellectual property and all embodiments of such intellectual property will

be promptly delivered to the Non-Bankrupt Party (a) upon any such commencement of a bankruptcy proceeding and upon written request by the Non-Bankrupt Party, unless the Bankrupt Party elects to continue to perform all of its obligations under this Agreement, or (b) if not delivered under (a) above, upon the rejection of this Agreement by or on behalf of the Bankrupt Party and upon written request by the Non-Bankrupt Party. The Bankrupt Party (in any capacity, including debtor-in-possession) and its successors and assigns (including any trustee) agrees not to interfere with the exercise by Non-Bankrupt Party or its Related Parties of its rights and licenses to such intellectual property and such embodiments of intellectual property in accordance with this Agreement, and agrees to assist the Non-Bankrupt Party and its Related Parties in obtaining such intellectual property and such embodiments of intellectual property in the possession or control of Third Parties as reasonably necessary or desirable for the Non-Bankrupt Party to exercise such rights and licenses in accordance with this Agreement. The foregoing provisions are without prejudice to any rights the Non-Bankrupt Party may have arising under the Bankruptcy Code or other Laws.

6.6 No Other Rights. Except as otherwise expressly provided in this Agreement, under no circumstances shall a Party, as a result of this Agreement, obtain any ownership interest or other right in any Know-How, Patent Rights or other intellectual property rights of the other Party, including items owned, controlled or developed by the other Party, or provided by the other Party to the receiving Party at any time pursuant to this Agreement.

6.7 No Reach Through to Acquirer IP. Notwithstanding anything in this Agreement to the contrary, following the closing of a Change of Control of a Party (the "**Acquired Party**"), the Parties agree that the other Party (the "**Non-Acquired Party**") shall not obtain rights or access to the Patent Rights or Know-How controlled by the Acquirer (as defined below) or any of the Affiliates of such Acquirer (other than the Acquired Party and its Affiliates which exist immediately prior to the closing of such Change of Control (such Affiliates, the "**Pre-Existing Affiliates**")); and the Acquirer and its Affiliates (other than the Acquired Party and its Pre-Existing Affiliates) shall not obtain rights or access to the Patent Rights or Know-How controlled by the Non-Acquired Party or any of its Affiliates pursuant to this Agreement, or be bound by the restrictions set forth in Section 9.5.1. For clarity but without limitation, the Non-Acquired Party's rights in all Patent Rights and Know-How Controlled by the Acquired Party or any of its Pre-Existing Affiliates, which Patent Rights and Know-How exist as of the date of the closing of such Change of Control and are then licensed hereunder to the Non-Acquired Party, shall remain licensed to such Non-Acquired Party after the date of the closing of such Change of Control in accordance with and subject to the terms and conditions of this Agreement and shall not be affected in any manner by virtue of such Change of Control. "**Acquirer**" means, with respect to the Acquired Party, the Third Party that acquires such Acquired Party or its direct or indirect controlling Affiliate, or that acquires all or substantially all of the assets of the Acquired Party or its direct or indirect controlling Affiliate.

7. CERTAIN FINANCIAL TERMS

7.1 Upfront Fee. As partial consideration for the licenses and other rights granted by Alnylam to MedCo under this Agreement, and to fund Alnylam's Development Costs under the Initial Development Plan up to the Development Costs Cap under this Agreement, within five (5) days after

the Effective Date, MedCo shall pay Alnylam a non-refundable, non-creditable initial payment of Twenty-Five Million U.S. Dollars ($25,000,000).

7.2 Development Milestone Fees.

(a) As partial consideration for the licenses and other rights granted in this Agreement, and to fund Alnylam's Development Costs under the Initial Development Plan up to the Development Costs Cap under this Agreement, MedCo shall make the non-refundable, non-creditable milestone payments to Alnylam set forth below no later than [***] days after the earliest date on which MedCo becomes aware that the corresponding milestone event has first been achieved with respect to a Licensed Product.

Milestone Event	Milestone Payment
(i) First dosing of a subject in a Phase I Study of a Licensed Product	$10,000,000
[***]	[***]
[***]	[***]
[***]	[***]
[***]	[***]

(b) Each milestone payment by MedCo to Alnylam hereunder shall be payable only once, regardless of the number of times achieved with respect to a Licensed Product or the Licensed Products and in no event shall the total milestone payments under this Section 7.2 exceed eighty million dollars ($80,000,000).

(d) MedCo shall provide Alnylam with written notice of the achievement by MedCo or any of its Related Parties of any milestone event set forth in Section 7.2(a)(ii)-(v) within [***] days after MedCo becomes aware of such event; *provided, however*, that, except as required by Law, MedCo shall inform Alnylam of such event prior to any public disclosure of such event by MedCo.

(e) Alnylam shall provide MedCo with written notice of the achievement by Alnylam or any of its Related Parties of any milestone event set forth in Section 7.2(a)(i) within [***] after Alnylam becomes aware of such event; *provided, however*, that, except as required by Law, Alnylam shall inform MedCo of such event prior to any public disclosure of such event by Alnylam.

7.3 Sales Milestone Fees. As partial consideration for the licenses and other rights granted in this Agreement, MedCo shall make the non-refundable, non-creditable milestone payments to Alnylam set forth below no later than [***] after the end of the Calendar Year in which the

corresponding milestone event (a "**Sales Milestone**") has first been achieved with respect to the Licensed Products.

Aggregate Calendar Year Net Sales of the Licensed Products in the Territory Equals or Exceeds (in U.S. Dollars):	**Milestone Payment**
[***]	[***]
[***]	[***]
[***]	[***]

With respect to the foregoing Sales Milestones, payment shall be made only once for each milestone regardless of the number of times aggregate Calendar Year Net Sales for Licensed Products in the Territory reach a particular dollar threshold and in no event shall the total milestone payments under this Section 7.3 exceed one hundred million dollars ($100,000,000). If Licensed Products achieve a higher Sales Milestone in a Calendar Year without having first achieved a lower Sales Milestone in any previous Calendar Year, then the milestone payment(s) for the lower Sales Milestone(s) shall be due and payable to Alnylam concurrently with the milestone payment for the higher Sales Milestone that has been achieved. For example, if aggregate Net Sales of the Licensed Products in the Territory are $[***] in the first Calendar Year, and then $[***] in the next Calendar Year, then MedCo will owe Alnylam a milestone payment of $[***] with respect to the second Calendar Year ($[***] for the $[***] milestone and $[***] for the $[***] milestone).

7.4 Royalties.

7.4.1 Royalties Payable on Licensed Products. Subject to the terms and conditions of this Agreement, as partial consideration for the licenses and other rights granted in this Agreement MedCo shall pay to Alnylam royalties on aggregate Net Sales by MedCo and its Related Parties of all Licensed Products in the Territory, as follows:

Aggregate Calendar Year Net Sales of all Licensed Products in the Territory	**Royalty (as a percentage of Net Sales)**
[***]	[***]
[***]	[***]
[***]	[***]
[***]	[***]

Royalties on aggregate Net Sales shall be paid at the rate applicable to the portion of such aggregate Net Sales within each of the Net Sales levels above during such Calendar Year.

7.4.2 Royalty Term. The period during which the royalties set forth in Section 7.4.1 shall be payable, on a Licensed Product-by-Licensed Product and country-by-country basis, shall commence with the First Commercial Sale of such Licensed Product in such country and continue until the latest of (a) the expiration of the last Valid Claim of any Patent Right that is (i) included in Alnylam Technology or MedCo Improvements, and (ii) Covers the manufacture, use, offer for sale, sale or importation of the Licensed Product in such country of sale, (b) the expiration of Regulatory Exclusivity for such Licensed Product in such country, and (c) the twelfth (12^{th}) anniversary of the First Commercial Sale of the Licensed Product in such country (each such period, a "**Royalty Term**").

7.4.3 Royalty Adjustment for Generic Competition. Subject to Section 7.4.6, the royalties to be paid by MedCo to Alnylam pursuant to this Section 7.4 shall be reduced by [***] percent ([***]%) with respect to Net Sales in a country of the Territory of any Licensed Product as to which Generic Competition exists. "**Generic Competition**" means, with respect to a Licensed Product in any country in the Territory in a given Calendar Quarter, that, during such Calendar Quarter, one or more Generic Products are commercially available in such country and such Generic Products have a combined market share (calculated on the basis of the number of units sold) of at least [***] percent ([***]%) of the aggregate market share of Licensed Products and Generic Products (based on data provided by IMS International, or if such data is not available, such other reliable data source as reasonably agreed by the Parties).

7.4.4 [***]

7.4.5 Royalty Adjustment for Necessary Third Party IP. Subject to Section 7.4.6, (a) if MedCo or any of its Related Parties is required to obtain a license or similar right from any Third Party under any Patent Rights that would be infringed by the practice of the Alnylam Patent Rights with respect to Licensed Products in the Field, and if MedCo or any of its Related Parties is required to pay to such Third Party a royalty, license fees or milestone payments to obtain such license or similar right with respect to the Development, Manufacture or Commercialization of Licensed Products in the Field, then the royalties to be paid by MedCo to Alnylam on Net Sales of a Licensed Product pursuant to this Section 7.4 in a Calendar Quarter shall be reduced by [***] percent ([***]%) of the amount of such royalty, license fees or milestone payments reasonably attributable to the Development, Manufacture or Commercialization of such Licensed Product and actually paid to such Third Party to the extent MedCo, directly or indirectly, bears the cost of such payment in such Calendar Quarter, and (b) the royalties to be paid by MedCo to Alnylam on Net Sales of a Licensed Product pursuant to this Section 7.4 in a Calendar Quarter shall be reduced by [***] percent ([***]%) of the amount of any payments made by MedCo to Alnylam pursuant to Section 6.4.3.2(c) reasonably attributable to the Development, Manufacture or Commercialization of such Licensed Product and actually paid to such Third Party to the extent MedCo, directly or indirectly, bears the cost of such payment in such Calendar Quarter.

7.4.6 Royalty Floor. Notwithstanding the foregoing provisions of this Section 7.4, in no event during the applicable Royalty Term for a Licensed Product in a country of the Territory shall the

royalties payable to Alnylam hereunder for such Licensed Product in such country for any Calendar Quarter be reduced pursuant to Sections 7.4.3, 7.4.4, and 7.4.5 to less than [***] percent ([***]%) of the royalties payable pursuant to Section 7.4.1 as to such Licensed Product in such country for such Calendar Quarter.

7.4.7 Reports; Payment of Royalty. During the Term, following the First Commercial Sale of the Licensed Product in the Territory, MedCo shall furnish to Alnylam a written report within [***] days after the end of each Calendar Quarter showing, on a Licensed Product-by-Licensed Product and country-by-country basis, the gross sales of each Licensed Product in each country of the Territory, deductions from gross sales (itemized by deduction category) for each Licensed Product for each country of the Territory included in the calculation of Net Sales, the Net Sales in each country of the Territory of Licensed Product during the reporting period, a calculation of royalty adjustments pursuant to Section 7.4 (if any) for such period and the royalties payable under this Agreement. Quarterly reports shall be due no later than the [***] day following the end of each Calendar Quarter. In addition, to the extent required under Sections 6.1.3(b) or 6.4.1, MedCo shall prepare and deliver to Alnylam any additional reports as required under the Alnylam In-Licenses and to determine any payments due under Section 6.4. Royalties shown to have accrued by each royalty report shall be due and payable on the date such royalty report is due. Along with the last report for a Calendar Year provided hereunder, MedCo will provide a final report for such entire Calendar Year that includes a calculation of [***] (if any) for such period, and a statement on whether any reconciling payments must be made at such time to effect the intent of Section 7.4.4. Within [***] days after such statement is provided, the Party that owes any amounts to the other Party to effect such reconciliation will pay the relevant amount to the other Party. MedCo and its Related Parties shall keep complete and accurate records in sufficient detail to enable the royalties and other payments payable hereunder, and, to the extent required under Sections 6.1.3(b) or 6.4.1, by Alnylam to Third Parties under the Alnylam In-Licenses, to be determined.

7.4.8 Blended Royalty Rates. The Parties acknowledge and agree that the Patent Rights and Know-How licensed pursuant to this Agreement justify royalty rates of differing amounts with respect to the sales of Licensed Products, which rates could be applied separately to Licensed Products involving the exercise of such Licensed Patents and/or the incorporation of such Know-How, and that, if such royalties were calculated separately, royalties relating to Patent-Rights and royalties relating to Know-How would last for different terms. Notwithstanding the foregoing, the Parties have determined, for reasons of convenience, that blended royalty rates for the Patent Rights and the Know-How licensed hereunder, as set forth above, will apply during a single Royalty Term.

7.5 Audits.

7.5.1 Upon the written request of a Party and not more than [***], the other Party and its Related Parties shall permit an independent certified public accounting firm of internationally-recognized standing selected by the requesting Party and reasonably acceptable to the other Party, at the requesting Party's expense except as set forth below, to have access during normal business hours to such of the records of the other Party as may be reasonably necessary to verify the accuracy of the royalty, Cost reimbursement and other reports hereunder for any Calendar Year ending not more than

[***] Calendar Years prior to the date of such request for the sole purpose of verifying the basis and accuracy of costs incurred under Section 2.3.1, to the extent Alnylam has provided notice thereof to MedCo pursuant to Section 2.3.3, and payments made under Sections 2.3.3, 6.4 and, if applicable, 12.3 and Articles 5, 7 and 11. The records for any Calendar Year may be audited no more than once.

7.5.2 If such accounting firm identifies a discrepancy made during such period, the appropriate Party shall pay the other Party the amount of the discrepancy, together with late-payment interest in accordance with Section 7.7, within [***] days after the date the requesting Party delivers to the other Party such accounting firm's written report so concluding, or as otherwise agreed by the Parties in writing. The fees charged by such accounting firm shall be paid by the requesting Party, unless such discrepancy results from a reporting error by the other Party and represents an underpayment by such other Party of at least five percent (5%) of the total amounts due from such other Party hereunder, or represents an overpayment to such other Party of at least five percent (5%) of the total amounts due to such other Party hereunder, in a Calendar Year, in which case such fees, to the extent reasonable, shall be paid by the other Party.

7.5.3 To the extent required under Sections 6.1.3(b) or 6.4.1, and subject to Section 6.4, MedCo shall comply with all applicable audit requirements in the Alnylam In-Licenses and shall include in each sublicense granted by it pursuant to this Agreement a provision requiring its Sublicensees to make reports to Alnylam, to keep and maintain records of sales made pursuant to such sublicense and to grant access to such records by the independent accountants of the Person(s) that are also party to such Alnylam In-Licenses to the same extent required of MedCo under this Agreement.

7.5.4 Unless an audit for a Calendar Year has been commenced prior to the [***] anniversary of the end of such Calendar Year, the calculation of royalties, Cost reimbursement and other payments payable with respect to such Calendar Year shall be binding and conclusive upon both Parties, and each Party and its Related Parties shall be released from any further liability or accountability with respect to such royalties or expense reimbursement for such Calendar Year, upon such [***] anniversary. If an audit for a Calendar Year has been commenced prior to the [***] anniversary of the end of such Calendar Year, the calculation of royalties, Cost reimbursement and other payments payable with respect to such Calendar Year shall be binding and conclusive upon both Parties, and each Party and its Related Parties shall be released from any further liability or accountability with respect to such royalties or expense reimbursement for such Calendar Year, following the conclusion of such audit.

7.5.5 Each Party shall treat all financial information subject to review under this Section 7.5 or under any sublicense agreement as the audited Party's Confidential Information in accordance with the confidentiality and non-use provisions of this Agreement, and shall cause its accounting firm to enter into an acceptable confidentiality agreement with the audited Party and/or its Related Parties obligating it to retain all such information in confidence pursuant to such confidentiality agreement.

7.6 Payment Exchange Rate. All payments to be made under this Agreement shall be made in United States dollars and shall be paid by bank wire transfer in immediately available funds to such bank account in the United States as may be designated in writing by the receiving Party from

time to time. In the case of Net Sales made or expenses incurred by a Party and its Related Parties in currencies other than United States dollars, the rate of exchange to be used in computing the amount of United States dollars due shall be the rate of exchange utilized by such Party in its worldwide accounting system and calculated in accordance with generally accepted accounting principles in the United States consistently applied, prevailing on the last day of each Calendar Quarter for royalty payments.

7.7 **Late Payments**. Any amount owed by a Party to the other Party under this Agreement that is not paid on or before the date such payment is due shall bear interest at a rate per annum equal to the lesser of (a) the then current one (1) month London Inter-Bank Offering Rate for US Dollars, as quoted on the British Banker's Association's website currently located at www.bba.org.uk (or such other source as may be mutually agreed by the Parties), plus [***] percentage points, per annum or (b) the highest rate permitted by Law, calculated on the number of days such payments are paid after such payments are due and compounded monthly.

7.8 **Blocked Payments**. If, by reason of Laws in any jurisdiction in the Territory, it becomes impossible or illegal for a Party to transfer milestone payments, royalties or other payments under this Agreement to the other Party, the payor shall promptly notify the payee. During any such period described above, the payor shall deposit such payments in local currency in the relevant jurisdiction to the credit of the payee in a recognized banking institution designated by the payee or, if none is designated by the payee within a period of [***] days, in a recognized banking institution selected by the payor and identified in a written notice given to the payee.

7.9 **Taxes**.

7.9.1 The Parties acknowledge and agree that, as of the Effective Date, no deduction for any tax withholding shall be required with respect to the payments due under this Agreement. Each Party (the "**Paying Party**") shall use reasonable efforts to minimize tax withholding on payments made to the other Party (the "**Payee**"). Notwithstanding such efforts, if the Paying Party concludes that tax withholdings under the Laws of any country are required with respect to payments to the Payee, the Paying Party shall promptly notify the Payee and allow the Payee [***] Business Days to determine whether there are actions the Payee can lawfully undertake to avoid such withholding. The Paying Party shall refrain from making such payment until the earliest to occur of: (a) such [***] Business Day period has expired; (b) the Payee instructs the Paying Party that the Payee intends to take actions that will reduce, or obviate the need for, such withholding, in which case the Paying Party shall make such payment (and future payments subject to the same or similar treatment), subject to no or such reduced withholding of tax, only after (i) it is instructed to do so by the Payee and (ii) it has received written advice from the Payee's counsel, in form and substance reasonably satisfactory to the Paying Party, that such actions have been taken, are lawful and are effective to so reduce or eliminate such withholding; or (c) the Payee instructs the Paying Party to make such payment and withhold the required amount of tax and pay it to the appropriate Governmental Authority in accordance with applicable Laws, in which case, the Paying Party shall take such actions and shall promptly thereafter provide the Payee with copies of receipts or other evidence of such withheld amount and such payment, including to the extent reasonably available to the Paying Party, such evidence as is

reasonably required and sufficient to allow the Payee to document such tax withholdings adequately for purposes of claiming foreign tax credits and similar benefits. The Parties will cooperate reasonably in completing and filing documents required under the provisions of any applicable tax Laws or under any other applicable Law, in connection with the making of any required tax withholding payment, or in connection with any claim to a refund of, or credit for, any such payment. Each Party will reasonably cooperate with the other Party (at such other Party's expense and request) to minimize such taxes imposed on such other Party in accordance with applicable Laws.

7.9.2 Notwithstanding the foregoing, if, as a result of (a) the assignment of this Agreement by the Paying Party to an Affiliate or a Third Party outside of the United States or (b) the exercise by the Paying Party of its rights under this Agreement through an Affiliate or Third Party outside of the United States, foreign withholding tax in excess of the foreign withholding tax amount that would have been payable in the absence of such assignment or exercise of rights becomes payable with respect to amounts due to the Payee hereunder, such amount due to the Payee will be increased so that the amount actually paid to the Payee (after withholding of the excess withholding tax) equals the amount that would have been payable to the Payee in the absence of such excess withholding.

7.9.3 For clarity, the provisions of Sections 7.9.1 and 7.9.2 shall not apply to taxes imposed on a Party's net income.

7.10 Invoices. To the extent necessary for the Paying Party to comply with applicable Law or GAAP, the Paying Party may require the other Party to issue an invoice to the Paying Party for any amount due by the Paying Party hereunder prior to the Paying Party paying such amount.

7.11 Good Faith Disputes Over Payment Obligations, With respect to any payment due or purported to be due hereunder, the portion of any such payment which is disputed in good faith shall not be owed until the dispute is resolved, and the Parties shall use good faith efforts to promptly resolve such dispute; *provided*, *however*, that any such amount finally determined to be due shall be paid with interest pursuant to Section 7.7 from the date originally due (without regard to this Section 7.11).

8. CONFIDENTIALITY AND PUBLICATION

8.1 Nondisclosure Obligation.

(a) All Confidential Information disclosed by one Party to the other Party hereunder shall be maintained in confidence by the receiving Party and shall not be disclosed to a Third Party or used for any purpose except as set forth herein without the prior written consent of the disclosing Party, except that no information or data shall be considered Confidential Information to the extent that such information or data:

(i) is known by the receiving Party at the time of its receipt, and not through a prior disclosure by the disclosing Party, as documented by the receiving Party's business records;

(ii) is in the public domain or publicly known by use and/or publication before its receipt from the disclosing Party (or, with respect to Joint Collaboration IP, before its development hereunder), or thereafter enters the public domain or becomes publicly known through no fault of the receiving Party;

(iii) is subsequently disclosed to the receiving Party by a Third Party who may lawfully do so and is not under an obligation of confidentiality to the disclosing Party; or

(iv) is developed by the receiving Party independently of Confidential Information received from the disclosing Party (including any Joint Collaboration IP), as documented by the receiving Party's business records.

(b) Notwithstanding the obligations of confidentiality and non-use set forth above and in Section 8.2 below, a receiving Party may provide Confidential Information disclosed to it, and disclose the existence and terms of this Agreement, as may be reasonably required in order to perform its obligations and to exploit its rights under this Agreement, to (i) Related Parties, and their employees, directors, agents, consultants, advisors and/or other Third Parties for the performance of its obligations hereunder (or for such entities to determine their interest in performing such activities) in accordance with this Agreement, in each case who are obligated to keep such Confidential Information confidential on terms no less stringent than those in this Section 8.1; (ii) Governmental Authorities or other Regulatory Authorities in order to obtain patents in accordance with this Agreement, or otherwise perform its obligations or exploit its rights under this Agreement; *provided*, that such Confidential Information shall be disclosed only to the extent reasonably necessary to do so; (iii) the extent required by Law, including by the rules or regulations of the United States Securities and Exchange Commission or similar regulatory agency in a country other than the United States or of any stock exchange or listing entity; (iv) any bona fide actual or prospective underwriters, investors, lenders, other financing sources, acquirers, permitted sublicensees, collaborators or strategic partners and to consultants and advisors of such Party, in each case who are obligated to keep such Confidential Information confidential on terms no less stringent than those in this Section 8.1; and (v) Third Parties to the extent a Party is required to do so pursuant to the terms of an In-License.

If a Party is required by Law to disclose Confidential Information that is subject to the non-disclosure provisions of this Section 8.1 or Section 8.2, such Party shall, to the extent permitted by Law, promptly inform the other Party of the disclosure that is being sought in order to provide the other Party an opportunity to challenge or limit the disclosure obligations. Confidential Information that is required to be disclosed by Law shall remain otherwise subject to the confidentiality and non-use provisions of this Section 8.1 and Section 8.2. If either Party concludes that a copy of this Agreement must be filed with the United States Securities and Exchange Commission or similar regulatory agency in a country other than the United States, such Party will provide the other Party with a copy of this Agreement showing any provisions hereof as to which the Party proposes to request confidential treatment, will provide the other Party with an opportunity to comment on any such proposed redactions and to suggest additional redactions, and will take such Party's reasonable and timely comments into consideration before filing the Agreement.

8.2 Publication and Publicity.

8.2.1 Publication. MedCo and Alnylam each acknowledge the other Party's interest in publishing the results of the Collaboration. Each Party also recognizes the mutual interest in obtaining valid patent protection and in protecting trade secret information. Consequently, except for disclosures permitted pursuant to Section 8.1, 8.2.2(b) or 8.2.2(c), either Party wishing to make a publication or public presentation of Development results that contains the Confidential Information of the other Party shall deliver to the other Party a copy of the proposed written publication or presentation at least [***] days prior to submission for publication or presentation. The reviewing Party shall have the right (a) to propose modifications to the publication or presentation for patent reasons, trade secret reasons or business reasons, which proposals the publishing Party may accept or reject in its discretion, and (b) to request a reasonable delay in publication or presentation in order to protect patentable information in accordance with Article 11. If the reviewing Party requests a delay pursuant to clause (b), the publishing Party shall delay submission or presentation for a period of an additional [***] days to enable the non-publishing Party to file patent applications protecting such Party's rights in such information in accordance with Article 11. With respect to any proposed publications or disclosures by clinical investigators or academic or non-profit collaborators, such materials shall be subject to review under this Section 8.2 to the extent that MedCo or Alnylam, as the case may be, has the right and ability (after using Commercially Reasonable Efforts to obtain such right and ability) to do so.

8.2.2 Publicity.

(a) Except as set forth in Section 8.1 above and clause (b) below, the terms of this Agreement may not be disclosed by either Party, and no Party shall use the name, trademark, trade name or logo of the other Party or its employees in any publicity, news release or disclosure relating to this Agreement or its subject matter, without the prior express written permission of the other Party, except as may be required by Law or expressly permitted by the terms of the Transaction Agreements.

(b) Following the execution of this Agreement, the Parties shall issue a joint press release agreed to by the Parties and substantially in the form set forth in Schedule F. After such initial press release, except as provided in Sections 8.1, 8.2.2(a), or 8.2.2(c), neither Party shall issue a press release or public announcement relating to this Agreement without the prior written approval of the other Party, which approval shall not be unreasonably withheld, conditioned or delayed, except that a Party may (i) once a press release or other public statement is approved in writing by both Parties, make subsequent public disclosure of the information contained in such press release or other written statement without the further approval of the other Party, and (ii) issue a press release or public announcement as required, in the reasonable judgment of such Party, by Law, including by the rules or regulations of the United States Securities and Exchange Commission or similar regulatory agency in a country other than the United States or of any stock exchange or listing entity.

(c) Either Party may issue a press release or make a public disclosure relating to this Agreement or the Parties' activities under this Agreement to the extent that such disclosure describes the commencement and/or "top-line" results of Clinical Trials of a Licensed Product conducted by such Party, the achievement by such Party of any material Development events with respect to a

Licensed Product or the filing for or receipt of Regulatory Approval with respect to the Licensed Product by such Party or its Related Parties in the Territory, or amounts paid to either Party in respect of the achievement of any milestone events. Prior to making any such disclosure, the Party making the disclosure shall provide the other Party with a draft of such proposed disclosure at least five (5) Business Days (or, to the extent faster timely disclosure of a material event is required by Law or stock exchange or stock market rules, such shorter period of time sufficiently in advance of the disclosure so that the other Party will have the opportunity to comment upon the disclosure and the disclosing Party will be able to comply with its obligations) prior to making any such disclosure, for the other Party's review and comment, which shall be considered in good faith by the disclosing Party.

(d) Subject to Sections 8.2.1 and 8.2.2(c), MedCo and its Related Parties may make public announcements or disclosures reasonably necessary or useful to Develop or Commercialize the Licensed Products in the Field in the Territory, including disclosures necessary to recruit subjects to clinical trials and disclosures to advertise, promote and otherwise Commercialize the Licensed Products.

9. REPRESENTATIONS, WARRANTIES AND COVENANTS; INDEMNIFICATION

9.1 Mutual Representations and Warranties. Each Party represents and warrants to the other Party that as of the Effective Date:

9.1.1 It is duly organized and validly existing under the laws of its jurisdiction of incorporation or formation, and has full corporate or other power and authority to enter into this Agreement, and to carry out the provisions hereof.

9.1.2 It is duly authorized to execute and deliver this Agreement, and to perform its obligations hereunder, and the person or persons executing this Agreement on its behalf has been duly authorized to do so by all requisite corporate action.

9.1.3 This Agreement is legally binding upon it and enforceable in accordance with its terms. The execution, delivery and performance of this Agreement by it does not conflict with any agreement, instrument or understanding, oral or written, to which it is a party and by which it may be bound, or with its charter or by-laws.

9.1.4 It has not granted, and will not grant, during the Term, any right to any Affiliate or Third Party that would conflict with the rights granted to the other Party hereunder.

9.1.5 Neither it nor any of its Affiliates has been debarred or is subject to debarment.

9.2 Representations and Warranties of Alnylam. Except as provided in Schedule G, Alnylam represents and warrants to MedCo that as of the Effective Date:

9.2.1 (a) Alnylam is the sole and exclusive owner of, or otherwise has the right to license to MedCo as set forth in this Agreement, pursuant to an Alnylam In-License (or will Control pursuant to

an Additional Alnylam In-License at such time that such Additional Alnylam In-License is included as an Alnylam In-License pursuant to Section 6.4.2.3), the Alnylam Technology. (b) All of the Alnylam Technology licensed to MedCo hereunder in the Territory that is solely and exclusively owned by Alnylam or its Affiliates is free and clear of liens, charges or encumbrances, other than licenses granted to Third Parties that are not inconsistent with the rights and licenses granted to MedCo under this Agreement. (c) The Alnylam Technology and the Patent Rights licensed by Alnylam pursuant to the Additional Alnylam In-Licenses constitute all the intellectual property that Alnylam or its Affiliates own or have rights under that are or may be reasonably necessary or useful for the Development, Manufacturing and Commercialization of the Licensed Products.

9.2.2 Alnylam has sufficient legal and/or beneficial title and ownership of, or sufficient license rights under, the Alnylam Patent Rights listed in Schedule C to grant the licenses to such Alnylam Patent Rights granted to MedCo pursuant to this Agreement.

9.2.3 (a) To Alnylam's knowledge, Schedule C-1 sets forth a complete and accurate list of the Alnylam Core Technology Patent Rights. (b) To Alnylam's knowledge, Schedule C-2 sets forth a complete and accurate list of the Alnylam Product-Specific Patent Rights. (c) Schedules C-1 and C-2 collectively set forth a complete and accurate list of the Alnylam Patent Rights owned, either solely or jointly, by Alnylam or its Affiliates. (d) To Alnylam's knowledge, Schedules C-1and C-2 collectively set forth a complete and accurate list of the Alnylam Patent Rights licensed, either exclusively or nonexclusively, to Alnylam or its Affiliates. (e) To Alnylam's knowledge, each issued Alnylam Patent Right remains in full force and effect. (f) Alnylam or its Affiliates have timely paid all filing and renewal fees payable with respect to such Alnylam Patent Rights for which Alnylam controls prosecution and maintenance. (g) Schedules C-1 and C-2 indicate whether each Alnylam Patent Right is owned exclusively by Alnylam or its Affiliates, is owned jointly by Alnylam and one or more Affiliates or Third Parties, or is licensed to Alnylam or its Affiliates. (h) For each Alnylam Patent Right that is owned, but not owned exclusively, by Alnylam or its Affiliates, or that is licensed to Alnylam or its Affiliates, Schedules C-1 and C-2 identify the Third Party owner(s) and, if applicable, the Alnylam In-License pursuant to which Alnylam Controls such Alnylam Patent Right. (i) For each Alnylam Product-Specific Patent Right that is licensed, but not exclusively licensed, to Alnylam or its Affiliates, Schedule C-2 indicates the non-exclusive nature of the license. (j) For each Alnylam Core Technology Patent Right family (other than Patent Rights licensed from Isis Pharmaceuticals, Inc.) that is licensed, but not exclusively licensed, to Alnylam or its Affiliates, Schedule C-1 indicates the non-exclusive nature of the license. (k) Alnylam or its Affiliates is/are the sole and exclusive owner(s) of all Patent Rights identified in Schedules C-1 or C-2 as being owned exclusively by Alnylam or its Affiliates and Alnylam Controls all other Patent Rights identified on such schedules. (l) To Alnylam's knowledge, Schedule C-3 sets forth a complete and accurate list of the Patent Rights licensed to Alnylam pursuant to the Additional Alnylam In-Licenses and which, if MedCo exercises its option pursuant to Section 6.4.2.3 with respect to the relevant Additional Alnylam In-License on the Effective Date, would be considered "Controlled" by Alnylam.

9.2.4 (a) To Alnylam's knowledge, the Alnylam Product-Specific Patent Rights, are, or, upon issuance, will be, valid and enforceable patents and no Third Party has challenged or threatened to challenge the scope, validity or enforceability of any Alnylam Product-Specific Patent Right

(including, by way of example, through opposition or the institution or written threat of institution of interference, nullity or similar invalidity proceedings before the United States Patent and Trademark Office or any analogous foreign Governmental Authority). (b) Alnylam has complied with all applicable Laws, including any duties of candor to applicable patent offices, in connection with its filing, prosecution and maintenance of the Alnylam Patent Rights for which Alnylam controls filing, prosecution and maintenance.

9.2.5 (a) Section A and Section C of Schedule D sets forth a complete and accurate list of all agreements between Alnylam or any of its Affiliates, on the one hand, and a Third Party(ies), on the other hand, entered into on or prior to the Effective Date and pursuant to which Alnylam or any of its Affiliates licenses or acquires any intellectual property rights owned or controlled by Alnylam or its Affiliates which are reasonably necessary or useful to Develop, Manufacture or Commercialize Licensed Products in the Field. (b) Alnylam and its Affiliates have not granted any Third Party, and are not under any obligation to grant any Third Party, any right to Develop, Manufacture or Commercialize Licensed Products in the Field in the Territory, except for the non-exclusive licenses granted to the Third Parties pursuant to the Existing Alnylam Third Party Agreements. (c) Alnylam Controls all Know-How and Patent Rights licensed to Alnylam under the Existing Alnylam In-Licenses that are necessary or useful for MedCo to Develop, Manufacture and/or Commercialize Licensed Products in the Field in the Territory. (d) Without limiting the generality of the foregoing, (i) Alnylam has obtained all necessary consents (if any) and fulfilled all necessary conditions (if any) to sublicense to MedCo under this Agreement such Know-How and Patent Rights licensed to Alnylam or its Affiliates under the Existing Alnylam In-Licenses, and (ii) Alnylam has obtained all necessary consents (if any) under the Existing Alnylam Third Party Agreements to grant the licenses to MedCo to Alnylam Technology that are purported to be granted to MedCo pursuant to this Agreement. (e) At such time that an Additional Alnylam In-License is included as an Alnylam In-License pursuant to Section 6.4.2.3, Alnylam will Control all Know-How, if any, and Patent Rights licensed to Alnylam or its Affiliates under such Additional Alnylam In-License that is necessary or useful for MedCo to Develop, Manufacture and/or Commercialize Licensed Products in the Field in the Territory.

9.2.6 To Alnylam's knowledge, neither Alnylam nor its Affiliates are in breach or default under any Existing Alnylam In-License or Additional Alnylam In-License, and neither Alnylam nor its Affiliates have received any written notice of breach or default with respect to any Existing Alnylam In-License or Additional Alnylam In-License.

9.2.7 Alnylam has provided MedCo with true and complete copies of all Existing Alnylam In-Licenses, Additional Alnylam In-Licenses and Existing Alnylam Third Party Agreements; *provided*, *however*, that, (a) to the extent that the terms of any such agreements require Alnylam to redact any provisions thereof before providing such agreements, or relevant portion thereof, to MedCo, Alnylam has provided MedCo with copies of such agreements, which are true and complete to the fullest extent possible under such agreements and that any provisions or portions which have not been provided to MedCo either (i) are not relevant to any obligations owed by MedCo, or rights granted to MedCo, under such agreement or any Transaction Agreement or (ii) have been summarized by Alnylam to MedCo in writing, and such summary is true and complete in all material respects; and (b) Alnylam is not required by this Section 9.2.7 to provide to MedCo copies of any amendment or side letter to any

Existing Alnylam In-License, Additional Alnylam In-License or Existing Alnylam Third Party Agreement which is not materially relevant to the rights granted to, and the obligations imposed on, MedCo under this Agreement.

9.2.8 To Alnylam's knowledge, the use, Development, Manufacture or Commercialization by Alnylam or MedCo (or their respective Related Parties) of any Licensed Product as formulated and manufactured as of the Effective Date, or as intended to be formulated and manufactured as of the Effective Date, (a) does not and will not infringe any issued, valid and enforceable patent of any Third Party or (b) will not infringe the claims of any published Third Party patent application when and if such claims were to issue in scope that was valid and enforceable.

9.2.9 There is no (a) claim, demand, suit, proceeding, arbitration, inquiry, investigation or other legal action of any nature, civil, criminal, regulatory or otherwise, pending or, to Alnylam's knowledge, threatened against Alnylam or any of its Affiliates or (b) judgment or settlement against or owed by Alnylam or any of its Affiliates, in each case in connection with the Alnylam Technology or any Licensed Product.

9.2.10 To Alnylam's knowledge, the Development of Licensed Product in the Territory to date has been conducted by Alnylam and its Affiliates and its subcontractors, in compliance (in all material respects) with all applicable Laws.

9.3 [Intentionally Omitted].

9.4 Warranty Disclaimer. EXCEPT AS OTHERWISE EXPRESSLY PROVIDED IN THIS AGREEMENT, NEITHER PARTY MAKES ANY REPRESENTATION OR EXTENDS ANY WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, TO THE OTHER PARTY WITH RESPECT TO ANY TECHNOLOGY, LICENSED PRODUCT, GOODS, SERVICES, RIGHTS OR OTHER SUBJECT MATTER OF THIS AGREEMENT AND HEREBY DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT WITH RESPECT TO ANY AND ALL OF THE FOREGOING. EACH PARTY HEREBY DISCLAIMS ANY REPRESENTATION OR WARRANTY THAT THE DEVELOPMENT, MANUFACTURE OR COMMERCIALIZATION OF THE LICENSED PRODUCTS PURSUANT TO THIS AGREEMENT WILL BE SUCCESSFUL OR THAT ANY PARTICULAR SALES LEVEL WITH RESPECT TO THE LICENSED PRODUCTS WILL BE ACHIEVED.

9.5 Certain Covenants.

9.5.1 Exclusivity. During the Term but subject to this Agreement including Sections 6.1.4 and 6.7, neither Party or its Affiliates will, without the prior written agreement of the other Party, alone or with or for an Affiliate or Third Party, or grant any Third Party a license to, research, develop, manufacture or commercialize in any country any product directed to the human PCSK9 gene, other than a Licensed Product pursuant to this Agreement. For purposes of this Section 9.5.1, "directed to" means, with respect to a compound, molecule or siRNA and a target, that such compound, molecule or siRNA modulates the expression or activity of such target, influences the expression or activity of such

target or otherwise antagonizes or inhibits the expression or activity of such target, and with respect to a product and a target, that such product contains a compound, molecule or siRNA that modulates the expression or activity of such target, influences the expression or activity of such target or otherwise antagonizes or inhibits the expression or activity of such target.

9.5.2 Compliance. Each Party and its Related Parties shall conduct the Collaboration and the Development, Manufacture and Commercialization of the Licensed Product in material accordance with all Laws and industry standards, including current governmental regulations concerning good laboratory practices, good clinical practices and good manufacturing practices.

9.5.3 Debarment. Neither Party nor any of its Affiliates will use in any capacity, in connection with the Collaboration or the performance of its obligations under this Agreement, any person or entity that has been debarred pursuant to Section 306 of the United States Federal Food, Drug, and Cosmetic Act, as amended, or that is the subject of a conviction described in such section. Each Party agrees to inform the other Party in writing immediately if it learns that (a) it or any person or entity that is performing activities in the Collaboration or under this Agreement, is debarred or is subject to debarment or is the subject of a conviction described in Section 306, or (b) any action, suit, claim, investigation or legal or administrative proceeding is pending or, to the notifying Party's knowledge, is threatened, relating to the debarment or conviction of the notifying Party or any person or entity used in any capacity by such Party or any of its Affiliates in connection with the Collaboration or the performance of its other obligations under this Agreement

10. INDEMNIFICATION; LIMITATION OF LIABILITY; INSURANCE

10.1 General Indemnification by MedCo. MedCo shall indemnify, hold harmless, and defend Alnylam, its Related Parties, and their respective directors, officers, employees and agents ("**Alnylam Indemnitees**") from and against any and all Third Party claims, suits, losses, liabilities, damages, costs, fees and expenses (including reasonable attorneys' fees) (collectively, "**Losses**") to the extent such Losses arise out of or result from, directly or indirectly, (a) any breach of, or inaccuracy in, any representation or warranty made by MedCo in the Transaction Agreements or any breach or violation of any covenant or agreement of MedCo in the Transaction Agreements, (b) the negligence or willful misconduct by or of MedCo and its Related Parties, and their respective directors, officers, employees and agents, in the performance of MedCo's obligations under the Transaction Agreements, or (c) the Development, Manufacture or Commercialization of Licensed Products by MedCo or its Related Parties. MedCo shall have no obligation to indemnify the Alnylam Indemnitees to the extent that the Losses arise out of or result from, directly or indirectly, any breach of, or inaccuracy in, any representation or warranty made by Alnylam in the Transaction Agreements, or any breach or violation of any covenant or agreement of Alnylam in the Transaction Agreements, or the negligence or willful misconduct by or of any of the Alnylam Indemnitees.

10.2 General Indemnification by Alnylam. Alnylam shall indemnify, hold harmless, and defend MedCo, its Related Parties and their respective directors, officers, employees and agents ("**MedCo Indemnitees**") from and against any and all Losses to the extent such Losses arise out of or result from, directly or indirectly, (a) any breach of, or inaccuracy in, any representation or warranty

made by Alnylam in the Transaction Agreements or any breach or violation of any covenant or agreement of Alnylam in the Transaction Agreements, (b) the negligence or willful misconduct by or of Alnylam and its Related Parties, and their respective directors, officers, employees and agents, in the performance of Alnylam's obligations under the Transaction Agreements, (c) the Development, Manufacture or Commercialization of Licensed Products by Alnylam or its Related Parties pursuant to the Initial Development Plan, the Development Supply Agreement or Section 12.3, or (d) the exercise by Alnylam or its Related Parties of its rights in Section 6.2.2. Alnylam shall have no obligation to indemnify the MedCo Indemnitees to the extent that the Losses arise out of or result from, directly or indirectly, any breach of, or inaccuracy in, any representation or warranty made by MedCo in the Transaction Agreements, or any breach or violation of any covenant or agreement of MedCo in the Transaction Agreements, or the negligence or willful misconduct by or of any of the MedCo Indemnitees.

10.3 Indemnification Procedure. In the event of any such claim against any MedCo Indemnitee or Alnylam Indemnitee (individually, an "**Indemnitee**"), the indemnified Party shall promptly notify the other Party in writing of the claim once the indemnified Party learns of it, and the indemnifying Party shall manage and control, at its sole expense, the defense of the claim and its settlement. The Indemnitee shall cooperate with the indemnifying Party, at the indemnifying Party's reasonable request and expense, and may, at its option and expense, be represented in any such action or proceeding. The indemnifying Party shall not be liable for any settlements, litigation costs or expenses incurred by any Indemnitee without the indemnifying Party's written authorization. The indemnifying Party shall not settle any such claim without the Indemnitee's consent, unless such settlement requires only payments by the indemnifying Party. Notwithstanding the foregoing, if the indemnifying Party believes that any of the exceptions to its obligation of indemnification of the Indemnitees set forth in Sections 10.1 or 10.2 may apply, the indemnifying Party shall promptly notify the Indemnitees, which shall then have the right to be represented in any such action or proceeding by separate counsel at their expense; *provided*, that the indemnifying Party shall be responsible for payment of such expenses if the Indemnitees are ultimately determined to be entitled to indemnification from the indemnifying Party for the matters to which the indemnifying Party notified the Indemnitees that such exception(s) may apply. To the extent that an indemnification obligation hereunder results in payments to a Third Party which are described in Section 6.4.3, the provisions of Sections 10.1 through 10.3 shall be subject to the provisions of Section 6.4.3 to the extent Section 6.4.3 is applicable.

10.4 Limitation of Liability. NEITHER PARTY HERETO WILL BE LIABLE FOR SPECIAL, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES ARISING OUT OF THIS AGREEMENT OR THE EXERCISE OF ITS RIGHTS HEREUNDER, INCLUDING LOST PROFITS ARISING FROM OR RELATING TO ANY BREACH OF THIS AGREEMENT, REGARDLESS OF ANY NOTICE OF SUCH DAMAGES, EXCEPT AS A RESULT OF A PARTY'S WILLFUL MISCONDUCT, A MATERIAL BREACH OF THE CONFIDENTIALITY AND NON-USE OBLIGATIONS IN ARTICLE 8, OR A BREACH OF THE EXCLUSIVITY PROVISION IN SECTION 9.5.1. NOTHING IN THIS SECTION 10.4 IS INTENDED TO LIMIT OR RESTRICT THE INDEMNIFICATION RIGHTS OR OBLIGATIONS OF EITHER PARTY.

10.5 Insurance. Each Party shall maintain insurance during the Term and for a period of at least [***] years after the last commercial sale of any Licensed Product under this Agreement by such Party or its Related Parties, with a reputable, solvent insurer in an amount appropriate for its business and products of the type that are the subject of this Agreement, and for its obligations under this Agreement. Specifically, each Party shall maintain product liability insurance of at least [***] U.S. Dollars ($[***]) per occurrence. Upon reasonable request, each Party shall provide the other Party with evidence of the existence and maintenance of such insurance coverage.

10.6 Obligations with Respect to IP Representations, Warranties and Covenants. In the event that Alnylam has materially breached any of its representations, warranties or covenants under Sections 9.2 or 6.4.4 and such breach has a material adverse effect on the rights of MedCo under this Agreement, then Alnylam shall use Commercially Reasonable Efforts to remedy such breach and obtain the right from the relevant Affiliate or Third Party in order to Control the relevant intellectual property such that it is considered Alnylam Technology and licensed or sublicensed to MedCo hereunder, and Alnylam shall bear any additional incremental payments that may be owed to such Affiliate or Third Party with respect to such remedy and such rights, license and sublicense, including any costs and expenses that might otherwise reasonably be imposed on MedCo or its Related Parties with respect to such consent or such rights, license or sublicense, other than the payment of royalties in accordance with Section 6.4.3 as set forth as of the Effective Date under any Existing Alnylam In-License (or any Additional Alnylam In-License, as the case may be) with respect to sales of Licensed Products by MedCo or its Related Parties. For clarity, the foregoing shall not be deemed to be MedCo's sole remedy with respect to such breach.

11. INTELLECTUAL PROPERTY OWNERSHIP, PROTECTION AND RELATED MATTERS

11.1 Inventorship. Inventorship for patentable inventions conceived or reduced to practice during the course of the performance of activities pursuant to this Agreement shall be determined in accordance with United States patent laws for determining inventorship.

11.2 Ownership. Alnylam shall own the entire right, title and interest in and to all inventions and discoveries (and Patent Rights claiming patentable inventions therein) first conceived or reduced to practice or, with respect to inventions and discoveries other than patentable inventions, otherwise identified, developed, made or discovered, solely by employees or consultants of Alnylam or acquired solely by Alnylam in the course of conducting the Collaboration. MedCo shall own the entire right, title and interest in and to all inventions and discoveries (and Patent Rights claiming patentable inventions therein) first conceived or reduced to practice or, with respect to inventions and discoveries other than patentable inventions, otherwise identified, developed, made or discovered, solely by employees or consultants of MedCo or acquired solely by MedCo in the course of conducting the Collaboration. The Parties shall jointly own any inventions and discoveries (and Patent Rights claiming patentable inventions therein) first conceived or reduced to practice or, with respect to inventions and discoveries other than patentable inventions, otherwise identified, developed, made or discovered, jointly in the course of conducting the Collaboration.

11.3 Prosecution and Maintenance of Patent Rights.

11.3.1 MedCo Technology and Product-Specific Technology. MedCo has the sole right and responsibility to, at MedCo's discretion, file, conduct prosecution, and maintain (including the defense of any interference, opposition or any other pre- or post-grant proceedings or challenges), all Patent Rights comprising MedCo Technology (other than Joint Collaboration IP), in MedCo's name.

11.3.2 Alnylam Technology.

(a) Subject to Sections 11.3.2(b) and 11.3.2(c), Alnylam has the sole right and responsibility to, at Alnylam's discretion, file, conduct prosecution, and maintain (including the defense of any interference, opposition or any other pre- or post-grant proceedings or challenges), all Patent Rights comprising Alnylam Technology (other than Joint Collaboration IP), in Alnylam's name. Alnylam agrees to use Commercially Reasonable Efforts to prosecute and maintain such Alnylam Patent Rights in the Major Market Countries, and to prosecute and maintain Alnylam Product-Specific Patent Rights in all other countries reasonably requested by MedCo.

(b) Alnylam shall provide MedCo, sufficiently in advance for MedCo to comment, with copies of all patent applications and other material submissions and correspondence intended to be filed with any patent counsel or patent authorities pertaining to Patent Rights comprising Alnylam Product-Specific Patent Rights, and Alnylam shall consider in good faith MedCo's reasonable and promptly provided comments and advice with respect to the prosecution or maintenance strategy with respect to such Patent Rights; *provided*, *however*, that if Alnylam determines that MedCo's comments or advice are not reasonable, Alnylam shall promptly notify MedCo thereof and the Parties shall promptly discuss such determination. If the Parties cannot promptly reach agreement with respect to such issue, the Parties shall hire an outside patent attorney, mutually agreeable to the Parties, to determine which Party's approach is more likely to obtain the broadest enforceable patent coverage for the Licensed Products in the Field, and the Parties shall implement such approach. In the event that MedCo fails to provide any such comments or advice reasonably in advance of a patent office deadline, Alnylam shall in good faith file a response designed to obtain the broadest enforceable patent coverage for the Licensed Products in the Field. Alnylam shall promptly provide MedCo with copies of all material correspondence received from any patent counsel or patent authorities pertaining to Patent Rights comprising Alnylam Product-Specific Patent Rights.

(c) In the event that Alnylam elects not to seek or continue to seek or maintain patent protection on any Alnylam Product-Specific Patent Rights, subject to the terms and conditions of any applicable Alnylam In-License or Existing Alnylam Third Party Agreement, Alnylam shall notify MedCo of such decision in sufficient time so as to permit MedCo to decide whether to seek, prosecute and maintain such Patent Right and to take any necessary actions without losing patent protection, and MedCo shall have the right (but not the obligation), at its expense, to seek, prosecute and maintain in any country patent protection on such Alnylam Product-Specific Patent Rights in the name of Alnylam. Alnylam shall use Commercially Reasonable Efforts to make available to MedCo its documentation, and its authorized attorneys, agents or representatives, and such of its employees, as are reasonably necessary to assist MedCo in obtaining and maintaining the patent protection described

under this Section 11.3.2(c). Alnylam shall sign or use Commercially Reasonable Efforts to have signed all legal documents necessary to file and prosecute such patent applications or to obtain or maintain such patents.

11.3.3 Joint Collaboration IP.

(a) Alnylam shall have the first right to, at Alnylam's discretion, file, prosecute and maintain (including the defense of any interference, opposition or any other pre- or post-grant proceedings or challenges), all Patent Rights comprising Joint Collaboration IP, in the names of both Alnylam and MedCo. Alnylam shall provide MedCo, sufficiently in advance for MedCo to comment, with copies of all patent applications and other material submissions and correspondence intended to be filed with any patent counsel or patent authorities pertaining to Patent Rights comprising Joint Collaboration IP, and Alnylam shall consider in good faith MedCo's reasonable and promptly provided comments and advice with respect to the prosecution or maintenance strategy with respect to such Patent Rights; *provided*, *however*, that if Alnylam determines that MedCo's comments or advice are not reasonable, Alnylam shall promptly notify MedCo thereof and the Parties shall promptly discuss such determination. If the Parties cannot promptly reach agreement with respect to such issue, the Parties shall hire an outside patent attorney, mutually agreeable to the Parties, to determine which Party's approach is more likely to obtain the broadest enforceable patent coverage for the Licensed Products in the Field, and the Parties shall implement such approach. In the event that MedCo fails to provide any such comments or advice reasonably in advance of a patent office deadline, Alnylam shall in good faith file a response designed to obtain the broadest enforceable patent coverage for the Licensed Products in the Field. Alnylam shall promptly provide MedCo with copies of all material correspondence received from any patent counsel or patent authorities pertaining to Patent Rights comprising Joint Collaboration IP. Each Party shall sign, or use Commercially Reasonable Efforts to have signed, all legal documents necessary to file and prosecute patent applications or to obtain or maintain patents in respect of such Joint Collaboration IP, at its own cost.

(b) In the event that Alnylam elects not to file or continue to prosecute or maintain patent protection on any Joint Collaboration IP in the Territory, Alnylam shall notify MedCo of such decision in sufficient time so as to permit MedCo to decide whether to seek, prosecute and maintain such Patent Right and to take any necessary actions without losing patent protection, and MedCo shall have the right (but not the obligation), to file, prosecute and maintain in any country Patent Rights comprising Joint Collaboration IP in the names of both Alnylam and MedCo. Alnylam shall use Commercially Reasonable Efforts to make available to MedCo its documentation, and its authorized attorneys, agents or representatives, and such of its employees, as are reasonably necessary to assist MedCo in obtaining and maintaining the patent protection described under this Section 11.3.3(b). Alnylam shall sign or use Commercially Reasonable Efforts to have signed all legal documents necessary to file and prosecute such patent applications or to obtain or maintain such patents.

11.3.4 Cooperation. With respect to the rights granted to a Party under Sections 11.3.2 or 11.3.3, each Party hereby agrees: (a) to make its employees, agents and consultants reasonably available to the other Party (or to the other Party's authorized attorneys, agents or representatives), to the extent reasonably necessary to enable such Party to undertake patent prosecution; (b) to provide the

other Party with copies of all material correspondence pertaining to prosecution with the patent offices; (c) to cooperate, if necessary and appropriate, with the other Party in gaining patent term extensions wherever applicable to Patent Rights licensed under this Agreement; and (d) to endeavor in good faith to coordinate its efforts with the other Party to minimize or avoid interference with the prosecution and maintenance of the other Party's patent applications.

11.3.5 Patent Expenses. Except as provided below with respect to Alnylam Product-Specific Patent Rights and Patent Rights comprising Joint Collaboration IP in the Territory, the patent filing, prosecution and maintenance expenses incurred after the Effective Date with respect to Patent Rights comprised of Alnylam Technology and MedCo Technology shall be borne by each Party having the right to file, prosecute and maintain such Patent Rights under this Section 11.3. MedCo shall reimburse Alnylam on a Calendar Quarter basis (and within thirty (30) days after receipt of an invoice) with respect to the out-of-pocket patent filing, prosecution and maintenance expenses incurred by Alnylam after the Effective Date with respect to the Alnylam Product-Specific Patent Rights in the Territory, up to [***] ($[***]) of such expenses per Calendar Year. The Parties shall share equally the out-of-pocket patent filing, prosecution and maintenance expenses incurred with respect to Patent Rights comprising Joint Collaboration IP. Each Party shall keep complete and accurate records with respect to such amount required to be paid by the other Party, and such other Party shall have the right to audit such records in accordance with Section 7.5.

11.3.6 Patent Term Extension. MedCo will determine, in its sole discretion, a strategy of seeking available patent term extension, restorations and supplementary protection certificates ("**SPC**") and other extensions from among Alnylam Product-Specific Patent Rights, MedCo Patent Rights and Patent Rights comprising Joint Collaboration IP, to the extent applicable, that will be designed to maximize patent protection and commercial value for the Licensed Products in the Field in the Territory, and the Parties, subject to the provisions of any In-License, will seek patent term extensions, restorations, SPCs and other extensions in all relevant countries in the Territory for such Patent Rights as selected by MedCo in accordance with that strategy. If MedCo determines not to so file for any extension, restoration or SPC for any of such Patent Rights in any relevant country of the Territory, it will give notice of such determination to Alnylam at least [***] days prior to the date on which such a filing must be made or the right to do so is lost, and Alnylam will have the right to make such filing. Where required under national law, Alnylam will make the filings for such extensions, restorations and SPCs for Alnylam Product-Specific Patents and, as applicable, will make, or cooperate with MedCo to make, the filing for Patent Rights comprising Joint Collaboration IP in the Territory, in each case as directed by MedCo. Each Party will execute such authorizations and other documents and take such other actions as may be reasonably requested by the other Party to obtain any such extensions, restorations and SPCs in the Territory.

11.4 Third Party Infringement.

11.4.1 Notices. Each Party shall promptly report in writing to the other Party any (a) known or suspected infringement of any Alnylam Technology, MedCo Technology or Joint Collaboration IP or (b) unauthorized use or misappropriation of any Confidential Information or Know-How of a Party by a Third Party of which it becomes aware, in each case to the extent such infringing, unauthorized or

misappropriating activities involve, as to a Licensed Product, a Generic Product or competing product in the Field ("**Competitive Infringement**"), and shall provide the other Party with all available evidence of such infringement, unauthorized use or misappropriation.

11.4.2 Rights to Enforce.

(a) **MedCo Technology**. Subject to the provisions of any In-License, MedCo shall have the sole and exclusive right to initiate an infringement or other appropriate suit anywhere in the world against any Third Party as to any infringement, or suspected infringement of, any Patent Rights, or of any use or suspected use without proper authorization of any Know-How, comprising MedCo Patent Rights, MedCo Know-How (other than MedCo's interest in Joint Collaboration IP), or MedCo Collaboration IP. MedCo will consider in good faith any request from Alnylam to initiate an infringement or other appropriate suit against any Third Party with respect to a Competitive Infringement in the Territory of MedCo Patent Rights, MedCo Know-How (other than MedCo's interest in Joint Collaboration IP) or MedCo Collaboration IP; *provided*, *however*, that MedCo shall not be required to initiate any such suit or permit Alnylam to initiate any such suit.

(b) **Alnylam Technology and Joint Collaboration IP**. Subject to the provisions of any In-License or Existing Alnylam Third Party Agreement, MedCo shall have the first right to initiate an infringement or other appropriate suit or action anywhere in the world against any Third Party with respect to any Competitive Infringement in the Territory of any Alnylam Product-Specific Patent Rights, Joint Collaboration IP (with respect to which MedCo shall consider Alnylam's input in good faith), or, with Alnylam's prior written consent, Alnylam Core Technology Patent Right or Alnylam Know-How (other than Alnylam's interest in Joint Collaboration IP). Alnylam will consider in good faith any request from MedCo to initiate an infringement or other appropriate suit against any Third Party with respect to a Competitive Infringement in the Territory of any Alnylam Core Technology Patent Right or such Alnylam Know-How (other than Alnylam's interest in Joint Collaboration IP); *provided*, *however*, that Alnylam shall not be required to initiate any such suit or permit MedCo to initiate any such suit.

(c) **Step-In Right**. If within [***] days after MedCo's receipt of a notice of a Competitive Infringement with respect to any Alnylam Product-Specific Patent Right or Joint Collaboration IP (or at least ten (10) days before the loss of the right to take an action as described in Section 11.4.2(b) and permitted hereunder with respect to such Competitive Infringement, except if MedCo has notified Alnylam in writing that it intends to, and actually does, take action as described in Section 11.4.2(b) and permitted hereunder against such Competitive Infringement), MedCo does not take any action as described in Section 11.4.2(b) and permitted hereunder against such Competitive Infringement in the relevant country in the Territory, Alnylam may in its sole discretion, bring and control any legal action in connection therewith at its sole expense.

11.4.3 Procedures; Expenses and Recoveries. The Party having the right to initiate any infringement suit under Section 11.4.2 above shall have the sole and exclusive right to select counsel for any such suit and shall pay all expenses of the suit, including attorneys' fees and court costs and reimbursement of the other Party's reasonable out-of-pocket expense in rendering assistance requested

by the initiating Party. If required under applicable Law in order for the initiating Party to initiate and/or maintain such suit, or if either Party is unable to initiate or prosecute such suit solely in its own name or it is otherwise advisable to obtain an effective legal remedy, in each case, the other Party shall join as a party to the suit and will execute and cause its Affiliates to execute all documents, and take all actions, reasonably necessary for the initiating Party to initiate litigation and maintain such action. In addition, at the initiating Party's request, the other Party shall provide other reasonable assistance to the initiating Party in connection with an infringement suit at no charge to the initiating Party except for reimbursement by the initiating Party of reasonable out-of-pocket expenses incurred in rendering such assistance. The non-initiating Party shall have the right to participate and be represented in any such suit under Section 11.4.2(b) or 11.4.2(c) by its own counsel at its own expense. If the Parties obtain from a Third Party, in connection with any such suit under Section 11.4.2(b) or 11.4.2(c), any damages, license fees, royalties or other compensation (including any amount received in settlement of such litigation), such amounts shall be allocated in all cases as follows:

(i) first, to reimburse each Party for all out-of-pocket expenses of the suit incurred by the Parties, including attorneys' fees and disbursements, court costs and other litigation expenses and, to the extent that such recovery is insufficient to fully reimburse each Party, each Party will be reimbursed pro rata in accordance with each Party's out-of-pocket expenses; and

(ii) second, the balance shall be paid as follows: (A) damages designated by the relevant court as multiple or punitive damages shall be paid [***] percent ([***]%) to the Party initiating the suit and [***] percent ([***]%) to the other Party; and (B) any other amounts shall be paid to MedCo, but, to the extent that MedCo would otherwise owe a royalty to Alnylam if MedCo or its Related Parties had sold the relevant Licensed Product subject to the Competitive Infringement in the Field in the relevant country in the Territory, such balance shall be considered "Net Sales" for purposes of determining royalties owed to Alnylam hereunder.

11.5 Trademarks. MedCo and its Related Parties have the sole right to use any trademark it owns or controls for Licensed Products in the Territory at its sole discretion, and each Party and its Related Parties shall retain all right, title and interest in and to its and their respective corporate names and logos. MedCo will develop one or more Product Trademark(s) for use by MedCo and its Related Parties in the Territory to Commercialize Licensed Products which have received Regulatory Approval in the Field in the Territory. MedCo (or its Related Parties, as appropriate) shall own all rights to such Product Trademarks and all goodwill associated therewith, throughout the Territory, and the rights to any Internet domain names incorporating the applicable Product Trademarks or any variation or part of such Product Trademarks used as its URL address or any part of such address. For the avoidance of doubt, neither Party shall have any right to use the other Party's or the other Party's Related Parties' corporate names or logos in connection with Commercialization of Licensed Products without the prior written consent of the other Party.

12. TERM AND TERMINATION

12.1 **Term**. This Agreement shall be effective as of the Effective Date and, unless terminated earlier pursuant to Section 12.2, this Agreement shall continue in effect on a Licensed Product-by-Licensed Product and country-by-country basis until expiration of the last Royalty Term to expire under this Agreement ("**Term**"). Upon expiration of the Term, all licenses of MedCo granted by Alnylam under Article 6 shall become fully paid-up, irrevocable, perpetual, non-exclusive, sublicenseable licenses.

12.2 Termination Rights.

12.2.1 Termination for Convenience. MedCo shall have the right to terminate this Agreement at any time after the Effective Date on four (4) months prior written notice to Alnylam.

12.2.2 Termination for Cause. This Agreement may be terminated at any time during the Term upon written notice by either Party (the "**Non-Breaching Party**") if the other Party (the "**Breaching Party**") is in material breach of its obligations hereunder and has not cured such breach within ten (10) days in the case of a payment breach, or within sixty (60) days in the case of all other breaches, after notice requesting cure of the breach, or, if cure of such breach other than non-payment cannot reasonably be effected within such sixty (60) day period, to deliver to the Non-Breaching Party a plan reasonably calculated to cure such breach within a timeframe that is reasonably prompt in light of the circumstances then prevailing, but in no event more than [***]. Following delivery of such a plan, the Breaching Party will carry out the plan and cure the breach. If the Breaching Party fails to cure a material breach of this Agreement as provided above, then the Non-Breaching Party may terminate this Agreement upon written notice to the Breaching Party.

12.2.3 Termination for Failure to Designate a Lead Product. Alnylam shall have the right to terminate this Agreement upon thirty (30) days prior written notice to MedCo in the event that a Lead Product has not been designated by the JSC (or by the Chief Executive Officer of MedCo pursuant to Section 4.4.3) prior to the earlier of: (a) thirty (30) days after Alnylam reaches the Development Costs Cap described in Section 2.3.1(a) and provides notice thereof to MedCo pursuant to Section 2.3.3, unless MedCo has agreed to pay or has paid the relevant Extra Early Development Costs; and (b) on or prior to June 30, 2015.

12.2.4 Challenges of Patent Rights. In the event that a Party (the "**Challenging Party**") or any of its Related Parties (a) commences or participates in any action or proceeding (including any patent opposition, re-examination or any other pre- or post-grant challenge or proceeding), or otherwise asserts any claim, challenging or denying the validity or enforceability (such an action or proceeding, a "**Challenge**") of any of the Patent Rights licensed to such Challenging Party by the other Party (the "**Licensor Party**") under this Agreement or any claim thereof or (b) actively assists any other person or entity in bringing or prosecuting any action or proceeding (including any patent opposition, re-examination or any other pre- or post-grant challenge or proceeding) challenging or denying the validity or enforceability of any of such Patent Rights or any claim thereof, then (i) such Challenging Party shall give notice thereof to such Licensor Party within [***] days of taking such action or of learning that its Related Party has taken such action, and (ii) such Licensor Party will have the right, in its sole discretion, to give notice to such Challenging Party that this Agreement will

terminate thirty (30) days following such notice (or such longer period as such Licensor Party may designate in such notice), and, unless, with respect to a challenge brought by such Challenging Party, such Challenging Party withdraws, or, with respect to a challenge brought by its Affiliates, causes, or, with respect to a challenge brought by its Sublicensee, uses Commercially Reasonable Efforts to cause, to be withdrawn, all such challenge(s) within such thirty (30)-day (or longer) period, this Agreement will so terminate. Notwithstanding the foregoing, in such event, MedCo, as the Licensor Party under this Agreement, may only terminate the licenses it has granted under this Agreement to Alnylam as the Challenging Party with respect to the Patent Rights that are the subject of the Challenge. In the event that such Licensor Party is not permitted under Law to terminate this Agreement such that the licenses with respect to all the Patent Rights under this Agreement are terminated, then the Parties agree to construe this provision to permit such Licensor Party to terminate only the licenses to that portion of such Patent Rights with respect to which such Licensor Party may terminate consistent with Law.

12.3 **Effect of Termination**. Without limiting any other legal or equitable remedies that either Party may have, if this Agreement is terminated by Alnylam, or by MedCo in accordance with Section 12.2.1, then:

(a) If this Agreement is terminated by MedCo pursuant to Section 12.2.1, then MedCo's obligation under Section 9.5.1 shall survive for a period of eight (8) months after the effective date of termination, and if this Agreement is terminated by Alnylam pursuant to Sections 12.2.2 or 12.2.4, then MedCo's obligations under Section 9.5.1 shall survive for a period of twelve (12) months after the effective date of termination.

(b) Subject to the terms and conditions of this Agreement (including Sections 6.4.1 and 6.4.4 with respect to the MedCo In-Licenses (if any) applicable to the rights granted to Alnylam pursuant to this Section 12.3(b)), MedCo shall and hereby does grant Alnylam a non-transferable (except as provided in Section 13.1), sublicenseable (subject to Section 6.2.3), worldwide, non-exclusive, royalty-bearing license, under any MedCo Technology that is produced, generated, conceived and/or reduced to practice as a result of the Development, Manufacturing or Commercialization activities of MedCo under this Agreement to Develop, Manufacture and Commercialize Licensed Products in the Field in the Territory. The Parties shall negotiate in good faith the royalty to be paid to MedCo by Alnylam in exchange for, and reflecting the then net present value of, the foregoing license, and, in the event that the Parties cannot mutually agree upon such amount within [***] days following the effective date of termination, the Parties will, as soon as reasonably practicable and in no event later than [***] days following the expiration of such [***]-day period, mutually decide upon an independent Third Party valuation firm with substantial experience in valuing licenses of intellectual property rights for the commercialization of pharmaceutical and biotechnology products, which shall make a final and binding determination of the net value of such license and both Parties shall promptly provide all reasonable materials and information requested by such valuation firm and shall share equally in the expenses of such valuation firm.

(c) MedCo shall use Commercially Reasonable Efforts to as promptly as practicable transfer to Alnylam or Alnylam's designee (i) possession and ownership of all governmental or regulatory correspondence, conversation logs, filings and approvals (including all Regulatory Approvals and pricing and reimbursement approvals) in MedCo's or its Affiliates' possession and Control relating to the Development, Manufacture or Commercialization of the Licensed Products and all Product Trademarks, (ii) copies of all data, reports, records and materials, and other sales and marketing related information in MedCo's or its Affiliates' possession and Control to the extent that such data, reports, records, materials or other information relate to the Development, Manufacture or Commercialization of Licensed Products, including all non-clinical and clinical data relating to Licensed Products, and customer lists and customer contact information and all adverse event data in MedCo's possession and Control, and (iii) all records and materials in MedCo's possession and Control containing Confidential Information of Alnylam. MedCo shall further appoint Alnylam as MedCo's and/or MedCo's Affiliates' agent for all Licensed Product-related matters involving Regulatory Authorities in the Territory until all such Regulatory Approvals and other regulatory filings have been transferred to Alnylam or its designee,

(d) if the effective date of termination is after First Commercial Sale, then MedCo shall appoint Alnylam as its exclusive distributor of the Licensed Product in the Territory and grant Alnylam the right to appoint sub-distributors, until such time as all such Regulatory Approvals in the Territory have been transferred to Alnylam or its designee,

(e) if MedCo or its Affiliates are Manufacturing Licensed Product, then at Alnylam's option, MedCo shall supply the Licensed Product to Alnylam in the Territory on commercially reasonable terms to be negotiated in good faith by the Parties, until such time as all such Regulatory Approvals in the Territory have been transferred to Alnylam or its designee, Alnylam has obtained all necessary manufacturing approvals or Alnylam has procured or developed its own source(s) of Licensed Product supply,

(f) if Alnylam so requests, MedCo shall use Commercially Reasonable Efforts to assign to Alnylam any Third Party agreements solely relating to the Development, Manufacture or Commercialization of the Licensed Product to which MedCo is a party, subject to any required consents of such Third Party, which MedCo shall use Commercially Reasonable Efforts to obtain promptly,

(g) MedCo shall promptly transfer and assign to Alnylam all of MedCo's and its Affiliates' rights, title and interests in and to the Product Trademark(s) owned by MedCo or its Affiliates and used for the Licensed Products in the Field in the Territory,

(h) MedCo shall transfer to Alnylam any inventory of Licensed Products Controlled by MedCo or its Affiliates as of the termination date, on commercially reasonable terms to be negotiated in good faith by the Parties,

(i) MedCo shall use Commercially Reasonable Efforts to provide, at Alnylam's reasonable expense, any other assistance reasonably requested by Alnylam for the purpose of allowing Alnylam or its designee to proceed expeditiously with the Development, Manufacture and Commercialization of Licensed Products in the Territory, and

(j) MedCo shall execute all documents and take all such further actions as may be reasonably requested by Alnylam in order to give effect to the foregoing clauses.

12.4 Effect of Expiration or Termination; Survival. Expiration or termination of this Agreement shall not relieve the Parties of any obligation accruing prior to such expiration or termination. Any expiration or termination of this Agreement shall be without prejudice to the rights of either Party against the other accrued or accruing under this Agreement prior to expiration or termination, including the obligation to pay royalties for the Licensed Product sold prior to such expiration or termination. The provisions of Articles 10 (other than Section 10.6) and 13, Sections 6.1.4(b), 6.3, 6.5, 6.6, 6.7, 8.1, 8.2.2, 9.4, 11.1, 11.2, 11.3.3, 11.3.4 (with respect to the rights granted to each Party under Section 11.3.3), 11.3.5 (with respect to Joint Collaboration IP), 12.3 (if applicable) and 12.4, Section 7.4.7 (with respect to any royalty report for the last Calendar Quarter), Sections 7.5 through 7.11 (with respect to amounts owed prior to expiration or termination of this Agreement or amounts due thereafter pursuant to Section 12.4), and the last sentences of Sections 6.1.1, 6.1.2 or 12.1 (with respect to the licenses which have converted as set forth therein on or before the expiration or termination of this Agreement) shall survive any expiration or termination of this Agreement. Except as set forth in this Article 12, upon termination or expiration of this Agreement all other rights and obligations of the Parties under this Agreement cease.

13. MISCELLANEOUS

13.1 Assignment. Except as provided in this Section 13.1, this Agreement may not be assigned or otherwise transferred, nor may any right or obligation hereunder be assigned or transferred, by either Party without the written consent of the other Party. However, either Party may, without the other Party's written consent, assign this Agreement and its rights and obligations hereunder in whole or in part to an Affiliate or to a Person that acquires, by merger, sale of assets or otherwise, all or substantially all of the business of the assigning Party to which the subject matter of this Agreement relates. The Parties acknowledge that MedCo is considering the potential assignment of all or a significant portion of its obligations under this Agreement to a Third Party joint venture in which MedCo may hold a non-controlling equity interest, and Alnylam agrees to discuss in good faith with MedCo such an assignment together with appropriate financial and other protections for Alnylam; *provided*, *however*, that nothing in the foregoing sentence shall be construed to require Alnylam to agree to such an assignment. The assigning Party shall remain responsible for the performance by its assignee of this Agreement or any obligations hereunder so assigned. Any assignment of the rights or obligations of this Agreement not in accordance with the foregoing shall be void.

13.2 Governing Law. This Agreement shall be construed and the respective rights of the Parties determined in accordance with the substantive laws of the State of New York, notwithstanding

any provisions of New York law governing conflicts of laws to the contrary, and the patent laws of the relevant jurisdiction without reference to any rules of conflict of laws.

13.3 Entire Agreement; Amendments. This Agreement and, when executed, the other Transaction Agreements, contain the entire understanding of the Parties with respect to the subject matter hereof, and supersedes all previous arrangements with respect to the subject matter hereof, whether written or oral, including the Mutual Confidential Disclosure Agreement made as of January 16, 2012 by the Parties. This Agreement (including the Schedules hereto) may be amended, or any term hereof modified, only by a written instrument duly-executed by authorized representatives of both Parties.

13.4 Severability. If any provision hereof should be held invalid, illegal or unenforceable in any respect in any jurisdiction, the Parties shall substitute, by mutual consent, valid provisions for such invalid, illegal or unenforceable provisions, which valid provisions in their economic effect are sufficiently similar to the invalid, illegal or unenforceable provisions that it can be reasonably assumed that the Parties would have entered into this Agreement with such valid provisions. In case such valid provisions cannot be agreed upon, the invalid, illegal or unenforceable of one or several provisions of this Agreement shall not affect the validity of this Agreement as a whole, unless the invalid, illegal or unenforceable provisions are of such essential importance to this Agreement that it is to be reasonably assumed that the Parties would not have entered into this Agreement without the invalid, illegal or unenforceable provisions.

13.5 Headings. The captions to the Articles and Sections hereof are not a part of this Agreement, but are merely for convenience to assist in locating and reading the several Articles and Sections hereof.

13.6 Interpretation. Whenever the context may require, any pronoun shall include the corresponding masculine, feminine and neuter forms and any noun shall include the corresponding singular and plural forms. The words "include", "includes" and "including" shall be deemed to be followed by the phrase "but not limited to." The word "will" shall be construed to have the same meaning and effect as the word "shall." "$" or "(D)(d)ollar" means U.S. Dollars. With respect to any license grant, "exclusive" means exclusive as between the licensor Party and the licensed Party to the fullest extent possible, in light of any rights already granted by the licensor Party to Third Parties prior to the date on which such license is first granted and in light of any limitations on the rights granted to the licensor Party by its licensors. Unless the context requires otherwise, (a) any definition of or reference to any agreement, instrument or other document herein shall be construed as referring to such agreement, instrument or other document as from time to time amended, supplemented or otherwise modified (subject to any restrictions on such amendments, supplements or modifications set forth herein or therein), (b) any reference to any Laws herein shall be construed as referring to such Laws as from time to time enacted, repealed or amended, (c) any reference herein to any Person shall be construed to include the Person's successors and permitted assigns, (d) the words "herein", "hereof" and "hereunder", and words of similar import, shall be construed to refer to this Agreement in its entirety and not to any particular provision hereof, (e) all references herein to Articles, Sections or Schedules shall be construed to refer to Articles, Sections and Schedules of this Agreement, (f) the

word “or” shall be construed to have the same meaning and effect as “and/or”, and (g) a term not defined herein but reflecting a different part of speech than a term which is defined herein shall be interpreted in a correlative manner.

13.7 **Waiver of Rule of Construction**. Each Party has had the opportunity to consult with counsel in connection with the review, drafting and negotiation of this Agreement. Accordingly, the rule of construction that any ambiguity in this Agreement shall be construed against the drafting Party shall not apply.

13.8 **No Implied Waivers; Rights Cumulative.** No failure on the part of Alnylam or MedCo to exercise, and no delay in exercising, any right, power, remedy or privilege under this Agreement, or provided by statute or at law or in equity or otherwise, shall impair, prejudice or constitute a waiver of any such right, power, remedy or privilege or be construed as a waiver of any breach of this Agreement or as an acquiescence therein, nor shall any single or partial exercise of any such right, power, remedy or privilege preclude any other or further exercise thereof or the exercise of any other right, power, remedy or privilege. Except as expressly provided in this Agreement, no right or remedy herein conferred upon or reserved to either Party is intended to be exclusive of any other right or remedy.

13.9 **Notices**. All notices which are required or permitted hereunder shall be in writing and sufficient if delivered personally, sent by facsimile (and promptly confirmed by personal delivery, registered or certified mail or overnight courier), sent by nationally-recognized overnight courier or sent by registered or certified mail, postage prepaid, return receipt requested, addressed as follows:

If to Alnylam, to: Alnylam Pharmaceuticals, Inc.
300 Third Street
Cambridge, MA 02142
Attention: Legal Department
Facsimile No.: (617) 551-8101

With a copy to: Faber Daeufer Itrato & Cabot PC
950 Winter Street
Waltham, MA 02451
Attention: Sumy C. Daeufer, Esq.
Facsimile No.: (781) 795-4747

If to MedCo, to: The Medicines Company
8 Sylvan Way
Parsippany, NJ 07054
Attention: President
Facsimile No.: (862) 207-6119

With a copy to: The Medicines Company
8 Sylvan Way
Parsippany, NJ 07054
Attention: General Counsel
Facsimile No.: (862) 207-6062

or to such other address as the Party to whom notice is to be given may have furnished to the other Party in writing in accordance herewith. Any such notice shall be deemed to have been given: (a) when delivered if personally delivered or sent by facsimile on a Business Day (or if delivered or sent on a non-Business Day, then on the next Business Day); (b) on receipt if sent by overnight courier; and/or (c) on receipt if sent by mail.

13.10 **Compliance with Export Regulations**. Neither Party shall export any technology licensed to it by the other Party under this Agreement except in compliance with U.S. export laws and regulations.

13.11 ***Force Majeure***. Neither Party shall be held liable to the other Party nor be deemed to have defaulted under or breached this Agreement for failure or delay in performing any obligation under this Agreement to the extent that such failure or delay is caused by or results from causes beyond the reasonable control of the affected Party, potentially including embargoes, war, acts of war (whether war be declared or not), insurrections, riots, civil commotions, strikes, lockouts or other labor disturbances, fire, floods, or other acts of God, or acts, omissions or delays in acting by any Governmental Authority or the other Party. The affected Party shall notify the other Party of such *force majeure* circumstances as soon as reasonably practical, and shall promptly undertake all reasonable efforts necessary to cure such *force majeure* circumstances.

13.12 **Dispute Resolution**. In the event that the Parties do not resolve any dispute, controversy or claim arising from, or related to, this Agreement or to the breach hereof (collectively, "**Dispute**") and neither Party has final decision-making authority as to such Dispute pursuant to Section 4.4, and a Party wishes to pursue the matter, such Party may file suit to have such Dispute adjudicated in a court of competent jurisdiction.

13.13 **Independent Contractors**. It is expressly agreed that Alnylam and MedCo shall be independent contractors and that the relationship between Alnylam and MedCo shall not constitute a partnership, joint venture or agency. Alnylam shall not have the authority to make any statements, representations or commitments of any kind, or to take any action, which shall be binding on MedCo, without the prior written consent of MedCo, and MedCo shall not have the authority to make any statements, representations or commitments of any kind, or to take any action, which shall be binding on Alnylam without the prior written consent of Alnylam.

13.14 **Counterparts**. The Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument. Facsimile signatures and signatures transmitted via PDF shall be treated as original signatures.

13.15 Performance by Affiliates. Each Party shall have the right to have any of its obligations hereunder performed by, any of its Affiliates and the performance of such obligations by any such Affiliate(s) shall be deemed to be performance by such Party; *provided*, *however*, that such Affiliate shall be bound by the corresponding obligations of such Party and such Party shall be responsible for ensuring the performance of its obligations under this Agreement and that any failure of any Affiliate performing obligations of such Party hereunder shall be deemed to be a failure by such Party to perform such obligations.

13.16 Binding Effect; No Third Party Beneficiaries. As of the Effective Date, this Agreement shall be binding upon and inure to the benefit of the Parties and their respective successors and permitted assigns. Except as expressly set forth in this Agreement, no person or entity other than the Parties and their respective permitted assignees hereunder shall be deemed an intended beneficiary hereunder or have any right to enforce any obligation of this Agreement.

[THE REMAINDER OF THIS PAGE HAS BEEN LEFT INTENTIONALLY BLANK]

IN WITNESS WHEREOF, the Parties have executed this Agreement as of the Effective Date.

THE MEDICINES COMPANY	**ALNYLAM PHARMACEUTICALS, INC.**
BY:/s/ Glenn Sblendorio	BY:/s/ John M. Maraganore
NAME: Glenn Sblendorio	NAME: John M. Maraganore, Ph.D.
TITLE: President and CFO	TITLE: Chief Executive Officer

[Signature Page to License and Collaboration Agreement]

SCHEDULE A

ALN-PCS02

ALN-PCS02 is an investigational ribonucleic acid interference (RNAi) therapeutic agent that is comprised of active pharmaceutical ingredient [***] (see sequence & diagram below), a synthetic small interfering RNA (siRNA) that is Targeted to the PCS messenger RNA (mRNA) in a [***] lipid nanoparticle formulation (see description below).

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. A total of 5 pages were omitted. [***]

SCHEDULE B

ALN-PCSsc

ALN-PCSsc is an investigational ribonucleic acid interference (RNAi) therapeutic agent that is comprised of an active pharmaceutical ingredient which is a synthetic small interfering RNA (siRNA) that is Targeted to the PCS messenger RNA (mRNA) and covalently linked on the 3′ end of the sense strand to a triantennary *N*-acetylgalactosamine ($GalNAc_3$) ligand (see diagram below). The active pharmaceutical ingredient may be [***] (see sequence & diagram below).

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. A total of 2 pages were omitted. [***]

SCHEDULE C

ALNYLAM PATENT RIGHTS

SCHEDULE C-1

ALNYLAM CORE TECHNOLOGY PATENT RIGHTS

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. A total of 183 pages were omitted. [***]

SCHEDULE C-2

ALNYLAM PRODUCT-SPECIFIC PATENT RIGHTS

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. A total of 8 pages were omitted. [***]

SCHEDULE C-3

PATENT RIGHTS IN ADDITIONAL ALNYLAM IN-LICENSES

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. A total of 16 pages were omitted. [***]

SCHEDULE D

EXISTING ALNYLAM IN-LICENSES,

EXISTING ALNYLAM THIRD PARTY AGREEMENTS AND ADDITIONAL ALNYLAM IN-LICENSES

A. As of the Effective Date, Existing Alnylam In-Licenses are the following Third Party agreements:

1. Co-Exclusive License Agreement between Max Planck Innovation GmbH (formerly Garching Innovation GmbH) and Alnylam Pharmaceuticals, Inc., dated December 20, 2002, as amended by Amendment dated July 2, 2003, the Requirements Amendment effective June 15, 2005, the Waiver Amendment effective August 9, 2007 and the Amendment to the Alnylam Co-Exclusive License Agreement dated as of March 14, 2011, by and between Alnylam Pharmaceuticals, Inc., on the one hand, and Whitehead Institute for Biomedical Research, Massachusetts Institute of Technology and Max-Planck-Innovation GmbH, on the other hand; and Co-Exclusive License Agreement between Max Planck Innovation GmbH (formerly Garching Innovation GmbH) and Alnylam Europe AG (formerly Ribopharma AG), dated July 30, 2003 (collectively, the "**Garching Agreements**")

2. Amended and Restated Strategic Collaboration & License Agreement between Isis Pharmaceuticals, Inc. and Alnylam Pharmaceuticals, Inc., dated April 28, 2009, as amended by letter agreement dated August 27, 2012 ("**Isis Agreement**")

3. Sponsored Research Agreement dated as of July 27, 2009 by and among Alnylam, The University of British Columbia ("**UBC**") and AlCana Technologies, Inc. ("**AlCana**")

4. Supplemental Agreement among Tekmira Pharmaceuticals Corporation ("**Tekmira**"), Protiva Biotherapeutics Inc. ("**Protiva**"), UBC and AlCana

5. Sublicense Agreement dated January 8, 2007 between Alnylam and Tekmira (as successor in interest to Inex Pharmaceuticals Corporation)

6. Cross-License Agreement by and among Alnylam, Tekmira and Protiva dated November 12, 2012 and Settlement Agreement and General Release dated November 12, 2012 by and among Tekmira, Protiva, Alnylam and AlCana

B. As of the Effective Date, Existing Alnylam Third Party Agreements are the following Third Party agreements:

1. License and Collaboration Agreement among F. Hoffmann-La Roche Ltd, Hoffman-La Roche Inc., and Alnylam Pharmaceuticals, Inc., dated July 8, 2007, as amended by letter amendment dated May 29, 2008 (assigned to Arrowhead Research Corporation in October 2011)

2. License and Collaboration Agreement between Takeda Pharmaceutical Company Limited and Alnylam Pharmaceuticals, Inc., dated May 27, 2008, as supplemented or amended by letter agreements dated August 18, 2009 and March 16, 2011

C. As of the Effective Date, the Additional Alnylam In-Licenses are the following Third Party agreements:

[***]

SCHEDULE E

INITIAL DEVELOPMENT PLAN

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. A total of 5 pages were omitted. [***]

SCHEDULE F

JOINT PRESS RELEASE

Contacts:

The Medicines Company
Michael Mitchell
Head of Global Communications
973-290-6097
michael.mitchell@themedco.com

Alnylam Pharmaceuticals, Inc.
Cynthia Clayton
Vice President, Investor Relations and
Corporate Communications
617-551-8207

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Spectrum
202-955-6222 x2597

DRAFT – Not for Release

The Medicines Company and Alnylam Form Strategic Alliance to Develop and Commercialize RNAi Therapeutics Targeting PCSK9 for the Treatment of Hypercholesterolemia

The Medicines Company Obtains Exclusive Global License to Advance ALN-PCS RNAi Therapeutic Program

Alnylam to Receive $25 Million in Upfront Payment in Addition to Milestone Payments and Royalties on Product Sales

Companies to Host Conference Call Today at 8:30 a.m. ET to Discuss Collaboration

Parsippany, N.J. and Cambridge, Mass., February 4, 2013 – The Medicines Company (Nasdaq: MDCO) and Alnylam Pharmaceuticals, Inc. (Nasdaq: ALNY), a leading RNAi therapeutics company, announced today that they have formed an exclusive global alliance for the development and commercialization of Alnylam's ALN-PCS RNAi therapeutic program for the treatment of hypercholesterolemia.

"This new alliance unites two organizations with a shared culture and commitment to innovation. In my view and past experience, there could be no stronger partner for our ALN-PCS program than The Medicines Company, which has demonstrated industry-wide leadership in the advancement of cardiovascular medicines to patients and remarkable success in its strategy of in-licensing, developing, and commercializing breakthrough products," said John Maraganore, Ph.D., Chief Executive Officer of Alnylam. "For Alnylam, this new partnership enables the advancement of ALN-PCS, an important program within our 'Alnylam 5x15' product development and commercialization strategy focused on RNAi therapeutics directed toward genetically validated targets. We believe that the ALN-PCS program holds great promise for the development of a significant therapeutic option for patients with hypercholesterolemia, and that the unique mechanism of action for ALN-PCS could provide a differentiated and potentially best-in-class strategy for PCSK9 antagonism."

"Our focus on acute and intensive care medicine has led us to a leadership position with Angiomax and potentially with cangrelor in the management of patients in extreme risk as a consequence of the rupture of their vulnerable coronary artery plaque at and around the time of acute coronary syndromes. Meantime, we have made progress with MDCO-216 (ApoA-1 Milano), a turbocharged form of HDL-C ('good cholesterol') which has the potential to modify disease through reverse cholesterol transport," said Clive Meanwell, M.D., Ph.D., Chairman and Chief Executive Officer of The Medicines Company. "Now, this exciting collaboration with Alnylam leaders in their field of RNAi adds a second potentially disease modifying approach and more cutting edge technology to our portfolio. We have seen that PCSK9 gene silencing can substantially reduce LDL-cholesterol in patients and has epidemiological and disease mechanisms studies suggest this can further reduce the risks of the world's number one killer, coronary artery disease. Clearly we see the complementarity of approaches which increase 'good cholesterol' (HDL-C) and decrease 'bad cholesterol' (LDL-C). We look forward to working with our colleagues at Alnylam for whom we have the greatest respect and admiration based upon earlier collaborations particularly around Angiomax, which was invented by John Maraganore."

PCSK9 (proprotein convertase subtilisin/kexin type 9) is a protein that regulates low-density lipoprotein (LDL) receptor levels on hepatocytes; gain-of-function human mutations in PCSK9 are associated with hypercholesterolemia while loss-of-function mutations are associated with lower levels of LDL cholesterol and a reduced risk of cardiovascular disease. ALN-PCS is a PCSK9 synthesis inhibitor that reduces intracellular and extracellular levels of PCSK9 resulting in lowered plasma levels of LDL-C. MDCO-216 is a naturally occurring variant of a protein found in high-density lipoprotein, or HDL. It is a reverse cholesterol transport agent designed to reduce atherosclerotic plaque burden development and thereby reduce the risk of adverse thrombotic events.

Under this alliance, The Medicines Company and Alnylam intend to collaborate on the advancement of the ALN-PCS program. Alnylam's ALN-PCS program includes ALN-PCS02 an intravenously administered RNAi therapeutic which has completed a Phase I trial, and ALN-PCSsc a subcutaneously administered RNAi therapeutic currently in pre-clinical development. Alnylam will continue the program while funded by The Medicines Company for an estimated one to two years to complete certain pre-clinical and Phase I clinical studies. The Medicines Company will then lead and fund development from Phase II forward and commercialize the ALN-PCS program if successful.

Under the terms of the agreement, The Medicines Company will make an upfront cash payment of $25 million to Alnylam. Alnylam may also receive potential development and commercial milestone payments of up to $180 million. Alnylam will be eligible to receive scaled double-digit royalties on global products sales of ALN-PCS products.

Alnylam has completed a Phase I trial of ALN-PCS02 in healthy volunteer subjects with elevated baseline LDL-C. Results showed that administration of a single intravenous dose of drug, in the absence of concomitant lipid-lowering agents such as statins, resulted in statistically significant and durable reductions of PCSK9 plasma levels of up to 84% and lowering of LDL-C of up to 50%. ALN-PCS02 was shown to be generally safe and well tolerated in this study and there were no serious adverse events related to study drug administration. Alnylam has also presented pre-clinical data from its ALN-PCSsc program demonstrating potent knockdown of the PCSK9 target gene with an ED_{50} of less than 0.3 mg/kg after a single subcutaneous dose.

“Cardiovascular disease remains the leading cause of mortality worldwide, with elevated LDL-C a major modifiable risk factor. New strategies are needed to dramatically and rapidly reduce LDL-C and prevent acute cardiovascular events that result from the rupture of cholesterol rich plaque when patients are at their most vulnerable,” said Daniel J. Rader, M.D., professor of Medicine and chief, Division of Translational Medicine and Human Genetics, at the Perelman School of Medicine at the University of Pennsylvania. “As a key regulator of the LDL receptor, liver-expressed PCSK9 is one of the most important and best validated new targets in molecular medicine for the treatment of hypercholesterolemia. The ALN-PCS data generated to date are very encouraging and I look forward to continued clinical studies that highlight the unique mechanistic approach of PCSK9 synthesis inhibitors.”

Dr. Rader serves as a member of Alnylam’s Scientific Advisory Board and as a consultant on Alnylam’s ALN-PCS program, and Alnylam and Dr. Rader collaborate on research for which Alnylam provides materials.

Conference Call Information
The Medicines Company and Alnylam will host a conference call today at 8:30 a.m. ET to discuss this new collaboration. To access the call, please dial 877-312-7507 (domestic) or 631-813-4828 (international) five minutes prior to the start time and refer to conference ID 96998933. A replay of the call will be available beginning at 11:30 a.m. ET. To access the replay, please dial 855-859-2056 (domestic) or 404-537-3406 (international) and refer to conference ID 96998933. A live audio webcast of the presentation will be available on The Medicines Company website at www.themedicinescompany.com, and on the News & Investors section of the Alnylam’s website, www.alnylam.com

About Hypercholesterolemia
Hypercholesterolemia is a condition characterized by very high levels of cholesterol in the blood which is known to increase the risk of coronary artery disease, the leading cause of death in the U.S. Some forms of hypercholesterolemia can be treated through dietary restrictions, lifestyle modifications (e.g.,

exercise and smoking cessation) and medicines such as statins. However, a large proportion of patients with hypercholesterolemia are not achieving target LDL-C goals with statin therapy, including genetic familial hypercholesterolemia patients, acute coronary syndrome patients, high-risk patient populations (e.g., patients with coronary artery disease, diabetics, symptomatic carotid artery disease, etc.) and other patients that are statin intolerant. Severe forms of hypercholesterolemia are estimated to affect more than 500,000 patients worldwide, and as a result, there is a significant need for novel therapeutics to treat patients with hypercholesterolemia whose disease is inadequately managed by existing therapies.

About ALN-PCS

ALN-PCS is a systemically delivered RNAi therapeutic targeting the gene proprotein convertase subtilisin/kexin type 9 (PCSK9), a target validated by human genetics that is involved in the metabolism of low-density lipoprotein cholesterol (LDL-C, or "bad" cholesterol). ALN-PCS therapies are PCSK9 synthesis inhibitors that lower levels of both intracellular and extracellular PCSK9, thereby phenocopying the human genetics observed in loss of function or null human PCSK9 mutations (*N. Engl. J. Med.* (2006) 354:1264-1272; *Am. J. Hum. Genet.* (2006) 79: 514-523). PCSK9 synthesis inhibition through an RNAi mechanism has the potential to lower tissue and circulating plasma PCSK9 protein levels resulting in higher LDL receptor levels in the liver, and subsequently lower LDL-C levels in the blood stream. Lower LDL-C is associated with a decreased risk of cardiovascular disease, including myocardial infarction and stroke.

About RNA Interference (RNAi)

RNAi (RNA interference) is a revolution in biology, representing a breakthrough in understanding how genes are turned on and off in cells, and a completely new approach to drug discovery and development. Its discovery has been heralded as "a major scientific breakthrough that happens once every decade or so," and represents one of the most promising and rapidly advancing frontiers in biology and drug discovery today which was awarded the 2006 Nobel Prize for Physiology or Medicine. RNAi is a natural process of gene silencing that occurs in organisms ranging from plants to mammals. By harnessing the natural biological process of RNAi occurring in our cells, the creation of a major new class of medicines, known as RNAi therapeutics, is on the horizon. Small interfering RNA (siRNA), the molecules that mediate RNAi and comprise Alnylam's RNAi therapeutic platform, target the cause of diseases by potently silencing specific mRNAs, thereby preventing disease-causing proteins from being made. RNAi therapeutics have the potential to treat disease and help patients in a fundamentally new way.

About The Medicines Company

The Medicines Company (Nasdaq: MDCO) provides medical solutions to improve health outcomes for patients in acute and intensive care hospitals worldwide. These solutions comprise medicines and knowledge that directly impact the survival and well being of critically ill patients.

The Medicines Company Forward-Looking Statement

Statements contained in this press release about The Medicines Company that are not purely historical, and all other statements that are not purely historical, may be deemed to be forward-looking statements for purposes of the safe harbor provisions under The Private Securities Litigation Reform Act of 1995.

Without limiting the foregoing, the words "believes," "anticipates" and "expects" and similar expressions are intended to identify forward-looking statements. These forward-looking statements involve known and unknown risks and uncertainties that may cause the Company's actual results, levels of activity, performance or achievements to be materially different from those expressed or implied by these forward-looking statements. Important factors that may cause or contribute to such differences include whether the Company's products will advance in the clinical trials process on a timely basis or at all, whether the Company will make regulatory submissions for product candidates on a timely basis, whether its regulatory submissions will receive approvals from regulatory agencies on a timely basis or at all, whether physicians, patients and other key decision makers will accept clinical trial results, and such other factors as are set forth in the risk factors detailed from time to time in the Company's periodic reports and registration statements filed with the Securities and Exchange Commission including, without limitation, the risk factors detailed in the Company's Quarterly Report on Form 10-Q filed on November 9, 2012, which are incorporated herein by reference. The Company specifically disclaims any obligation to update these forward-looking statements.

About Alnylam Pharmaceuticals

Alnylam is a biopharmaceutical company developing novel therapeutics based on RNA interference, or RNAi. The company is leading the translation of RNAi as a new class of innovative medicines with a core focus on RNAi therapeutics for the treatment of genetically defined diseases, including ALN-TTR for the treatment of transthyretin-mediated amyloidosis (ATTR), ALN-AT3 for the treatment of hemophilia and rare bleeding disorders (RBD), ALN-AS1 for the treatment of acute intermittent porphyria (AIP), ALN-PCS for the treatment of hypercholesterolemia, and ALN-TMP for the treatment of hemoglobinopathies. As part of its "Alnylam 5x15™" strategy, the company expects to have five RNAi therapeutic products for genetically defined diseases in clinical development, including programs in advanced stages, on its own or with a partner by the end of 2015. Alnylam has additional partnered programs in clinical or development stages, including ALN-RSV01 for the treatment of respiratory syncytial virus (RSV) infection and ALN-VSP for the treatment of liver cancers. The company's leadership position on RNAi therapeutics and intellectual property have enabled it to form major alliances with leading companies including Merck, Medtronic, Novartis, Biogen Idec, Roche, Takeda, Kyowa Hakko Kirin, Cubist, Ascletis, Monsanto, Genzyme, and The Medicines Company. In addition, Alnylam holds a significant equity position in Regulus Therapeutics Inc., a company focused on discovery, development, and commercialization of microRNA therapeutics. Alnylam has also formed Alnylam Biotherapeutics, a division of the company focused on the development of RNAi technologies for applications in biologics manufacturing, including recombinant proteins and monoclonal antibodies. Alnylam's VaxiRNA™ platform applies RNAi technology to improve the manufacturing processes for vaccines; GlaxoSmithKline is a collaborator in this effort. Alnylam scientists and collaborators have published their research on RNAi therapeutics in over 100 peer-reviewed papers, including many in the world's top scientific journals such as Nature, Nature Medicine, Nature Biotechnology, and Cell. Founded in 2002, Alnylam maintains headquarters in Cambridge, Massachusetts. For more information, please visit www.alnylam.com.

About "Alnylam 5x15™"

The "Alnylam 5x15" strategy, launched in January 2011, establishes a path for development and commercialization of novel RNAi therapeutics directed toward genetically defined targets for diseases

with high unmet medical need. Products arising from this initiative share several key characteristics including: a genetically defined target and disease; the potential to have a major impact in a high unmet need population; the ability to leverage the existing Alnylam RNAi delivery platform; the opportunity to monitor an early biomarker in Phase I clinical trials for human proof of concept; and the existence of clinically relevant endpoints for the filing of a new drug application (NDA) with a focused patient database and possible accelerated paths for commercialization. By the end of 2015, the company expects to have five such RNAi therapeutic programs in clinical development, including programs in advanced stages, on its own or with a partner. The "Alnylam 5x15" programs include ALN-TTR for the treatment of transthyretin-mediated amyloidosis (ATTR), ALN-AT3 for the treatment of hemophilia and rare bleeding disorders (RBD), ALN-AS1 for the treatment of acute intermittent porphyria (AIP), ALN-PCS for the treatment of hypercholesterolemia, ALN-TMP for the treatment of hemoglobinopathies, and other programs. Alnylam intends to focus on developing and commercializing certain programs from this product strategy itself in North and South America, Europe, and other parts of the world; these include ALN-TTR, ALN-AT3, and ALN-AS1; the company will seek global development and commercial alliances for other programs.

Alnylam Forward-Looking Statements

Various statements in this release concerning Alnylam's future expectations, plans and prospects, including without limitation, statements regarding Alnylam's views with respect to the potential for RNAi therapeutics, including the potential for the ALN-PCS program, including ALN-PCS02 and ALN-PCSsc, its expectations regarding the receipt of upfront and potential development and commercialization milestones and royalty payments on worldwide net sales, if any, under The Medicines Company agreement, and Alnylam's expectations regarding its "Alnylam 5x15" product strategy, constitute forward-looking statements for the purposes of the safe harbor provisions under The Private Securities Litigation Reform Act of 1995. Actual results may differ materially from those indicated by these forward-looking statements as a result of various important factors, including, without limitation, Alnylam's ability to successfully demonstrate the efficacy and safety of its drug candidates and the pre-clinical and clinical results for these product candidates, including ALN-PCS02 and ALN-PCSsc, which may not support further development of such product candidates, both our and The Medicines Company's ability to successfully advance ALN-PCS02 and/or ALN-PCSsc resulting in the potential payment of milestones and royalties to us, actions of regulatory agencies, which may affect the initiation, timing and progress of clinical trials for such product candidates, obtaining, maintaining and protecting intellectual property, obtaining regulatory approval for products, competition from others using technology similar to Alnylam's and others developing products for similar uses, and Alnylam's ability to establish and maintain strategic business alliances, including its collaboration with The Medicines Company, and new business initiatives, as well as those risks more fully discussed in the "Risk Factors" filed with Alnylam's current report on Form 8-K filed with the Securities and Exchange Commission (SEC) on January 14, 2013 and in other filings that Alnylam makes with the SEC. In addition, any forward-looking statements represent Alnylam's views only as of today and should not be relied upon as representing its views as of any subsequent date. Alnylam does not assume any obligation to update any forward-looking statements.

CERTAIN CONFIDENTIAL PORTIONS OF THIS EXHIBIT WERE OMITTED AND REPLACED WITH "[***]". A COMPLETE VERSION OF THIS EXHIBIT HAS BEEN FILED SEPARATELY WITH THE SECRETARY OF THE SECURITIES AND EXCHANGE COMMISSION PURSUANT TO AN APPLICATION REQUESTING CONFIDENTIAL TREATMENT UNDER RULE 24b-2 OF THE SECURITIES EXCHANGE ACT OF 1934.

SCHEDULE G

DISCLOSURE SCHEDULE

Section 9.2.1(a):
- Reference is made to certain claims alleged by the plaintiffs in the action entitled:

[***]

Section 9.2.2:
- Reference is made to certain claims alleged by the plaintiff in the [***] Litigation.

Section 9.2.5(c):
- Reference is made to certain claims alleged by the plaintiff in the [***] Litigation.

Section 9.2.8:
- [***]

Section 9.2.9(a):
- Reference is made to certain claims alleged by the plaintiff in the [***] Litigation.

Section 9.2.9(b):
- Reference is made to the [***].

- Reference is made to the [***].

SCHEDULE H

EXAMPLE FOR SECTION 6.4.3.3

If, with respect to a particular Alnylam In-License, royalties are payable with respect to aggregate net sales of all products covered by such Alnylam In-License, and are not determined on a product-by-product basis, according to the following tiered royalty rates:

Aggregate Calendar Year net sales by Alnylam, its Affiliates or any of its sublicensees of all products	**Royalty (as a percentage of such net sales)**
[***]	[***]
[***]	[***]
[***]	[***]
[***]	[***]

And if sales are made during each of the four Calendar Quarters of the relevant Calendar Year as shown in the table below, then royalties owed by MedCo pursuant to such Alnylam In-License shall be as shown in such table:

Sales By	Calendar Quarter 1	Calendar Quarter 2	Calendar Quarter 3	Calendar Quarter 4
[***]	[***]	[***]	[***]	[***]
[***]	[***]	[***]	[***]	[***]
[***]	[***]	[***]	[***]	[***]
[***]	[***]	[***]	[***]	[***]
[***]	[***]	[***]	[***]	[***]

Exhibit 10.48

CERTAIN INFORMATION IN THIS DOCUMENT, MARKED BY [**], HAS BEEN EXCLUDED PURSUANT TO REGULATION S-K, ITEM 601(b)(10)(iv). SUCH EXCLUDED INFORMATION IS NOT MATERIAL AND IS THE TYPE THAT THE REGISTRANT TREATS AS PRIVATE OR CONFIDENTIAL.

AMENDMENT NO. 2 TO LICENSE AND COLLABORATION AGREEMENT

THIS AMENDMENT NO. 2 TO LICENSE AND COLLABORATION AGREEMENT (this "**Amendment**"), effective as of October 31, 2022 (the "**Amendment Effective Date**"), by and between Alnylam Pharmaceuticals, Inc., a corporation organized and existing under the laws of the State of Delaware ("**Alnylam**") and The Medicines Company, a corporation organized and existing under the laws of Delaware ("**MedCo**") (each individually a "**Party**" and, collectively, the "**Parties**").

RECITALS:

WHEREAS, Alnylam and MedCo are parties to that certain License and Collaboration Agreement, dated as of February 3, 2013, as amended on November 22, 2019 (the "**Original Agreement**");

WHEREAS, Alnylam and MedCo now desire to amend certain provisions in the Original Agreement, as set forth in more detail below;

NOW, THEREFORE, in consideration of the foregoing premises and the mutual covenants herein contained, Alnylam and MedCo hereby agree as follows:

1. Section 3.4 is hereby deleted in its entirety and replaced with the following:

3.4 **Reporting Obligations**. MedCo shall prepare and deliver to Alnylam, by no later than each February 28 following the first Regulatory Approval of a Licensed Product in the Field in the Territory (for the period ending December 31 of the prior Calendar Year), written reports summarizing MedCo's Commercialization activities for Licensed Products performed to date (or updating such report for activities performed since the last such report submitted hereunder, as applicable). In addition, MedCo shall provide Alnylam with written notice of the First Commercial Sale of each Licensed Product in the Territory, as part of the written report provided by MedCo to Alnylam in accordance with Section 7.4.7. In addition to the foregoing, MedCo shall provide Alnylam with written notification within fifteen (15) days after the occurrence of a First Commercial Sale of each Product in the Territory on a country-by-country basis, for each of the following countries: the United States of America, China, Japan, Germany, France and the United Kingdom. MedCo shall also provide such other information to Alnylam as Alnylam may reasonably request with respect to MedCo's Commercialization activities with respect to Licensed Products.

2. Section 4.1.4 is hereby deleted in its entirety and replaced with the following:

4.1.4 **Meetings**. The first JSC meeting shall be held within two (2) months after the Effective Date, and the JSC shall thereafter meet in accordance with a schedule established by mutual written agreement of the Parties, but no less frequently than once per Calendar Quarter until after the first JSC meeting following the first Regulatory Approval of an NDA for a

Licensed Product in the United States, and no less frequently than once every six (6) months thereafter, with the location for such meetings alternating between Alnylam's and MedCo's US facilities (or such other locations as are mutually agreed by the Parties). Alternatively, the JSC may meet by means of teleconference, videoconference or other similar communications equipment, but at least one meeting per Calendar Year shall be conducted in person, to the extent reasonably practicable.

3. Section 4.5 is hereby deleted in its entirety and replaced with the following:

4.5 Dissolution of JSC. The JSC shall be dissolved after the occurrence of both of the following events: (i) the First Commercial Sale has occurred in all Major Market Countries (other than France) of the last Licensed Product that is expected to be Developed in the Territory, and (ii) there has been one JSC meeting subsequent to the occurrence of the event set forth in clause (i) hereto. Upon the dissolution of the JSC, MedCo shall have the sole rights and authority to take any action that had been within the JSC's purview.

4. Section 7.4.7 is hereby deleted in its entirety and replaced with the following:

7.4.7 Reports; Payment of Royalty.

(a) Within [**] Business Days after the end of the [**] within each [**], commencing with the [**] in which there is a [**], MedCo shall furnish to Alnylam a written, non-binding, good faith estimate of the Net Sales of Products recognized during such first two months of the calendar quarter calculated in accordance with GAAP [**]. Each [**] shall be Confidential Information of Novartis [**] Alnylam may disclose [**] solely to the extent necessary for the performance of its obligations under and in accordance with the Agreement (in each case who are obligated to keep such Confidential Information confidential on terms no less stringent than those in Section 8.1) [**].

(b) During the Term, following the First Commercial Sale of the Licensed Product in the Territory, MedCo shall furnish to Alnylam a written report within thirty (30) days after the end of each Calendar Quarter showing, [**], the royalties payable in United States dollars, a calculation of royalty adjustments pursuant to Section 7.4 (if any) and in accordance with Section 3.4 the First Commercial Sale of each Licensed Product in each country in the Territory (if any), in each case, during the reporting period. [**]. The Parties agree to enter into good faith negotiations to amend and/or suspend certain reports under this Section 7.4.7(b) for a particular country in the Territory in the event that compliance with such reports would prevent MedCo from entering into agreements with potential customers in such country.

Quarterly reports shall be due no later than the thirtieth (30th) day following the end of each Calendar Quarter. In addition, to the extent required under Sections 6.1.3(b) or 6.4.1, MedCo shall prepare and deliver to Alnylam any additional reports as reasonably required under the Alnylam In-Licenses, and to determine any payments due under Section 6.4. Royalties shown to have accrued by each royalty report shall be due and payable within forty five (45) days after the end of the relevant Calendar Quarter, provided that, prior to such payment, Alnylam shall have submitted an invoice to MedCo with respect to the royalty amount shown therein, substantially in the form as previously agreed with MedCo within five (5) days after

Medco having provided Alnylam with the relevant royalty report. If Alnylam submits its invoice after the end of such five (5) day period, then the due date for the corresponding royalties shall be extended by a number of days equal to the time period between the end of such five (5) day period and the submission of such invoice. Along with the last report for a Calendar Year provided hereunder, MedCo will provide a final report for such entire Calendar Year that includes a calculation of Excess Commercial COGS (if any) for such period, and a statement on whether any reconciling payments must be made at such time to effect the intent of Section 7.4.4. Within thirty (30) days after such statement is provided, the Party that owes any amounts to the other Party to effect such reconciliation will pay the relevant amount to the other Party. MedCo and its Related Parties shall keep complete and accurate records in sufficient detail to enable the royalties and other payments payable hereunder, and, to the extent required under Sections 6.1.3(b) or 6.4.1, by Alnylam to Third Parties under the Alnylam In-Licenses, to be determined.

(c) On or about August 01, 2025, the Parties shall confer and discuss in good faith whether the internal accounting capabilities, of MedCo, at that time more readily facilitate reporting of itemized deductions for the calculation of Net Sales hereunder. Following such discussion, [**].

5. Section 7.5 is hereby deleted in its entirety and replaced with the following:

7.5 Audits.

7.5.1 Upon the written request of a Party and not more than once in each Calendar Year, the other Party and its Related Parties shall permit an independent certified public accounting firm of internationally-recognized standing selected by the requesting Party and reasonably acceptable to the other Party, at the requesting Party's expense except as set forth below, to have access during normal business hours to such of the records of the other Party as may be reasonably necessary to verify the accuracy of the royalty, Cost reimbursement and other reports hereunder for any Calendar Year ending not more than three (3) Calendar Years prior to the date of such request for the sole purpose of verifying the basis and accuracy of costs incurred under Section 2.3.1, to the extent Alnylam has provided notice thereof to MedCo pursuant to Section 2.3.3, and payments made under Sections 2.3.3, 6.4 and, if applicable, 12.3 and Articles 5, 7 and 11. The records for any Calendar Year may be audited no more than once. The independent certified public accounting firm of internationally-recognized standing shall provide its audit report and basis for any determination to MedCo and Alnylam before it is considered final. Either Party shall have the right to request a further determination by such accounting firm as to matters which such Party disputes in respect of the audit report or basis for any determination within ten (10) days following receipt of such report. MedCo will provide Alnylam and the auditor with a reasonably detailed statement of the grounds upon which it disputes any findings in the audit report and the auditor shall undertake to complete such further determination within twenty (20) days after the dispute notice is provided. Following such further determination, the auditor shall promptly provide its final audit report to MedCo and Alnylam.

7.5.2 If such accounting firm identifies a discrepancy made during such period, the appropriate Party shall pay the other Party the amount of the discrepancy, together with late-payment interest in accordance with Section 7.7, within thirty (30) days after the date the

requesting Party delivers to the other Party such accounting firm's written report so concluding, or as otherwise agreed by the Parties in writing. The fees charged by such accounting firm shall be paid by the requesting Party, unless such discrepancy results from a reporting error by the other Party and represents an underpayment by such other Party of at least five percent (5%) of the total amounts due from such other Party hereunder, or represents an overpayment to such other Party of at least five percent (5%) of the total amounts due to such other Party hereunder, in a Calendar Year, in which case such fees, to the extent reasonable, shall be paid by the other Party.

7.5.3 To the extent required under Sections 6.1.3(b) or 6.4.1, and subject to Section 6.4, MedCo shall comply with all applicable audit requirements in the Alnylam In-Licenses and shall include in each sublicense granted by it pursuant to this Agreement a provision requiring its Sublicensees to make reports to Alnylam, to keep and maintain records of sales made pursuant to such sublicense and to grant access to such records by the independent accountants of the Person(s) that are also party to such Alnylam In-Licenses to the same extent required of MedCo under this Agreement.

7.5.4 Unless an audit for a Calendar Year has been commenced prior to the third (3rd) anniversary of the end of such Calendar Year, the calculation of royalties, Cost reimbursement and other payments payable with respect to such Calendar Year shall be binding and conclusive upon both Parties, and each Party and its Related Parties shall be released from any further liability or accountability with respect to such royalties or expense reimbursement for such Calendar Year, upon such third (3rd) anniversary. If an audit for a Calendar Year has been commenced prior to the third (3rd) anniversary of the end of such Calendar Year, the calculation of royalties, Cost reimbursement and other payments payable with respect to such Calendar Year shall be binding and conclusive upon both Parties, and each Party and its Related Parties shall be released from any further liability or accountability with respect to such royalties or expense reimbursement for such Calendar Year, following the conclusion of such audit.

7.5.5 Each Party shall treat all financial information subject to review under this Section 7.5 or under any sublicense agreement as the audited Party's Confidential Information in accordance with the confidentiality and non-use provisions of this Agreement, and shall cause its accounting firm to enter into an acceptable confidentiality agreement with the audited Party and/or its Related Parties obligating it to retain all such information in confidence pursuant to such confidentiality agreement.

6. Section 7.6 is hereby deleted in its entirety and replaced with the following:

7.6. **Payment Exchange Rate**. All payments to be made under this Agreement shall be made in United States dollars and shall be paid by bank wire transfer in immediately available funds to such bank account in the United States as may be designated in writing by the receiving Party from time to time. If any currency conversion is required in connection with the calculation of amounts payable hereunder, such conversion shall be made in a manner consistent with the paying Party's normal practices used to prepare its audited financial statements for external reporting purposes; provided that such practices use a widely accepted source of published exchange rates and in accordance with generally accepted accounting principles.

7. Section 7.7 is hereby deleted in its entirety and replaced with the following:

7.7 **Late Payments.** Any amount owed by a Party to the other Party under this Agreement that is not paid on or before the date such payment is due shall bear interest at a rate per annum equal to the lesser of [**].

8. Except as expressly amended by this Amendment, the Original Agreement remains in full force and effect. This Amendment contains the entire understanding of the Parties with respect to the subject matter hereof, and supersedes all previous arrangements with respect to the subject matter hereof. This Amendment shall be construed and the respective rights of the Parties determined in accordance with the substantive laws of the State of New York, notwithstanding any provisions of New York law governing conflicts of laws to the contrary, and the patent laws of the relevant jurisdiction without reference to any rules of conflict of laws. This Amendment may be executed in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument. Facsimile signatures and signatures transmitted via PDF shall be treated as original signatures.

[Remainder of page intentionally left blank]

IN WITNESS WHEREOF, the parties hereto have executed this Amendment as of the Amendment Effective Date.

THE MEDICINES COMPANY

By: /s/ Latonya M. Raston

Name: Latonya M. Raston

Title: Assistant Secretary

Date: October 31, 2022

ALNYLAM PHARMACEUTICALS, INC.

By: /s/ Vinayak Sharma

Name: Vinayak Sharma

Title: VP, Program & Alliance Management

Date: 11/1/2022

AMENDMENT TO PURCHASE AND SALE AGREEMENT

This AMENDMENT TO PURCHASE AND SALE AGREEMENT (this "Amendment") is effective as of October 31, 2022 and is between Alnylam Pharmaceuticals, Inc., a Delaware corporation (the "Seller"), and BX Bodyguard Royalties L.P., a Delaware limited partnership (the "Purchaser").

W I T N E S S E T H :

WHEREAS, the Seller and Purchaser are parties to that certain Purchase and Sale Agreement, dated as of April 10, 2020 (the "Original Agreement").

WHEREAS, the Seller and Purchaser desire to amend (with effectiveness as of October 31, 2022) certain provisions in the Original Agreement in connection with a planned amendment to the MedCo License Agreement (a copy of which is set forth in Exhibit A hereto) (the "MedCo Amendment"), as set forth in more detail below.

NOW, THEREFORE, in consideration of the premises and the mutual agreements, representations and warranties set forth herein and of other good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, the parties hereto covenant and agree as follows:

1. The following sentence is hereby added at the end of Section 5.7(a) of the Original Agreement: "Without limiting the generality of the foregoing, Seller shall promptly invoice Licensee (and in any event within five (5) Business Days of receipt by Seller of a Royalty Report or any other report triggering such invoice) to the extent an invoice is needed for receipt of payment of any Royalty or Milestone."

2. Pursuant to Section 5.7(a) of the Original Agreement, Purchaser hereby provides its written Consent (as defined in the Original Agreement) to the MedCo Amendment.

3. Except as expressly amended by this Amendment, the Original Agreement remains in full force and effect. This Amendment contains the entire understanding of the parties with respect to the subject matter hereof, and supersedes all previous arrangements with respect to the subject matter hereof. Section 10.7 of the Agreement shall apply to this Amendment. This Amendment may be signed in any number of counterparts, each of which shall be an original, with the same effect as if the signatures thereto and hereto were upon the same instrument. This Amendment shall become effective when each party hereto shall have received a counterpart hereof signed by the other party hereto. Any counterpart may be executed by facsimile or other electronic transmission, and such facsimile or other electronic transmission shall be deemed an original.

{SIGNATURE PAGE FOLLOWS}

IN WITNESS WHEREOF, the parties hereto have executed this Amendment effective as of October 31, 2022.

ALNYLAM PHARMACEUTICALS, INC.

By: /s/ Jeff Poulton
Name: Jeff Poulton
Title: Chief Financial Officer

BX BODYGUARD ROYALTIES L.P.

By: /s/ Robert W. Liptak
Name: Robert W. Liptak
Title: Senior Managing Director

EXHIBIT 21.1

SUBSIDIARIES OF THE REGISTRANT

Name	Ownership Percentage	Jurisdiction of Organization
Alnylam U.S., Inc.	100%	Delaware
Alnylam Securities Corporation	100%	Massachusetts
Sirna Therapeutics, Inc.	100%	Delaware
Alnylam Austria GmbH	100%	Austria
Alnylam Belgium SPRL/BVBA	100%	Belgium
Alnylam Brasil Farmaceutica Ltda.	99%	Brazil
Alnylam (Bermuda) Ltd.	100%	Bermuda
Alnylam Canada ULC	100%	Canada
Alnylam France SAS	100%	France
Alnylam Europe AG	100%	Germany
Alnylam Germany GmbH	100%	Germany
Alnylam Italy Srl	100%	Italy
Alnylam Japan KK	100%	Japan
Alnylam Netherlands BV	100%	Netherlands
Alnylam Pharmaceuticals Spain SL	100%	Spain
Alnylam Sweden AB	100%	Sweden
Alnylam Switzerland GmbH	100%	Switzerland
Alnylam Taiwan Co. Ltd.	100%	Taiwan
ALNYPT Unipessoal LDA	100%	Portugal
Alnylam UK Limited	100%	United Kingdom
Alnylam Czech s.r.o.	100%	Czech Republic
Alnylam Argentina Srl	95%	Argentina
Alnylam Australia Pty Ltd.	100%	Australia

Exhibit 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in the Registration Statements on Forms S-3 (No. 333-238989) and S-8 (Nos. 333-252994, 333-236409, 333-219840, 333-207251, 333-190498, 333-226533, 333-172370, 333-165105, 333-157633, 333-148114, 333-127450 and 333-116151) of Alnylam Pharmaceuticals, Inc. of our report dated February 23, 2023 relating to the financial statements and the effectiveness of internal control over financial reporting, which appears in this Form 10-K.

/s/ PricewaterhouseCoopers LLP
Boston, Massachusetts
February 23, 2023

Exhibit 31.1

CERTIFICATION

I, Yvonne L. Greenstreet, MBChB, certify that:

1) I have reviewed this Annual Report on Form 10-K of Alnylam 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 report is being prepared;

   b. Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   c. Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   d. Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5) The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   a. All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   b. Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 23, 2023

/s/ Yvonne L. Greenstreet, MBChB

Yvonne L. Greenstreet, MBChB
Chief Executive Officer

Exhibit 31.2

CERTIFICATION

I, Jeffrey V. Poulton, certify that:

1) I have reviewed this Annual Report on Form 10-K of Alnylam 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 report is being prepared;

   b. Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   c. Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   d. Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5) The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   a. All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   b. Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 23, 2023

/s/ Jeffrey V. Poulton

Jeffrey V. Poulton
Executive Vice President, Chief Financial Officer

Exhibit 32.1

CERTIFICATION 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 Alnylam Pharmaceuticals, Inc. (the "Company") for the fiscal year ended December 31, 2022 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), the undersigned, Yvonne L. Greenstreet, MBChB, Chief Executive Officer of the Company, hereby certifies, pursuant to Section 1350 of Chapter 63 of Title 18, United States Code, that, to her 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.

Date: February 23, 2023

/s/ Yvonne L. Greenstreet, MBChB

Yvonne L. Greenstreet, MBChB
Chief Executive Officer

A signed original of this written statement required by Section 906 has been provided to the Company and will be retained by the Company and furnished to the Securities and Exchange Commission or its staff upon request.

Exhibit 32.2

CERTIFICATION 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 Alnylam Pharmaceuticals, Inc. (the "Company") for the fiscal year ended December 31, 2022 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), the undersigned, Jeffrey V. Poulton, Executive Vice President, Chief Financial Officer, hereby certifies, pursuant to Section 1350 of Chapter 63 of Title 18, United States Code, 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.

Date: February 23, 2023

/s/ Jeffrey V. Poulton

Jeffrey V. Poulton
Executive Vice President, Chief Financial Officer

A signed original of this written statement required by Section 906 has been provided to the Company and will be retained by the Company and furnished to the Securities and Exchange Commission or its staff upon request.