INTREXON CORP
Form 10-K
March 01, 2019
Table of Contents

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

FORM 10-K

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

For the fiscal year ended December 31, 2018
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: 001-36042

INTREXON CORPORATION
(Exact name of registrant as specified in its charter)

Virginia	26-0084895
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification Number)
20374 Seneca Meadows Parkway Germantown, Maryland	20876
(Address of principal executive offices)	(Zip Code)

Registrant's telephone number, including area code (301) 556-9900
Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Name of each exchange on which registered
Intrexon Corporation Common Stock, No Par Value	Nasdaq Global Select Market

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

Table of Contents

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes x 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 x

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 x 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 x No ¨

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

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, 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	x	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 is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ¨ No x

As of June 30, 2018, the aggregate market value of the registrant's common stock held by non-affiliates based upon the closing price of such shares on the New York Stock Exchange on such date was approximately $959.4 million.

As of February 15, 2019, 160,408,958 shares of common stock, no par value per share, were issued and outstanding.

DOCUMENTS INCORPORATED BY REFERENCE: Portions of the registrant's Definitive Proxy Statement for its 2019 Annual Meeting of Shareholders are incorporated by reference in Part III of this Annual Report on Form 10-K where indicated. Such proxy statement will be filed with the Securities and Exchange Commission within 120 days of the registrant's fiscal year ended December 31, 2018.

Table of Contents

TABLE OF CONTENTS

Intrexon®, Trans Ova Genetics®, EnviroFlight®, Oxitec®, Arctic®, ActoBiotics®, ViaGen®, Okanagan Specialty Fruits®, RheoSwitch®, UltraVector®, Design-Build-Test-Learn®, AquAdvantage®, RTS®, and RheoSwitch Therapeutic System® are our and/or our affiliates' registered trademarks in the United States and AquaBounty™, GenVec™, Precigen™, AdenoVerse™, ActoBio Therapeutics™, Progentus™, AttSite™, LEAP™, Florian™ and Precigen Th are our and/or our affiliates' common law trademarks in the United States. This Annual Report on Form 10-K, or Annual Report, and the information incorporated herein by reference contain references to trademarks, service marks and trade names owned by us or other companies. Solely for convenience, trademarks, service marks and trade names referred to in this Annual Report and the information incorporated herein, including logos, artwork, and other visual displays, may appear without the ® or ™ symbols, but such references are not intended to indicate, in any way, that we will not assert, to the fullest extent under applicable law, our rights or the rights of the applicable licensor to these trademarks, service marks and trade names. We do not intend our use

Table of Contents

or display of other companies' trade names, service marks or trademarks to imply a relationship with, or endorsement or sponsorship of us by, any other companies. Other trademarks, trade names and service marks appearing in this Annual Report are the property of their respective owners. Unless the context requires otherwise, references in this Annual Report to "Intrexon", "we", "us", and "our" refer to Intrexon Corporation.

Special Note Regarding Forward-Looking Statements

This Annual Report contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995, which statements involve substantial risks and uncertainties. All statements, other than statements of historical facts, included in this Annual Report regarding our strategy, future events, future operations, future financial position, future revenue, projected costs, prospects, plans, objectives of management and expected market growth are forward-looking statements. The words "anticipate", "believe", "estimate", "expect", "intend", "may", "plan", "predict", "project", "would", and similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words. These forward-looking statements include, among other things, statements about:

- our strategy and overall approach to our business model;
- our ability to successfully enter new markets or develop additional products, whether independently or with our collaborators;
- our ability to successfully enter into optimal strategic relationships with our subsidiaries and operating companies that we may form in the future;
- competition from existing technologies and products or new technologies and products that may emerge;
- actual or anticipated variations in our operating results;
- our current and future joint ventures, or JVs, exclusive channel collaborations, or ECCs, license agreements and other collaborations;
- developments concerning our collaborators and licensees;
- actual or anticipated fluctuations in our competitors' or our collaborators' and licensees' operating results or changes in their respective growth rates;
- our cash position;
- market conditions in our industry;
- our ability to protect our intellectual property and other proprietary rights and technologies;
- our ability to adapt to changes in laws, regulations and policies;
- our ability and the ability of our collaborators and licensees to adapt to changes in laws, regulations and policies and to secure any necessary regulatory approvals to commercialize any products developed by us or under our ECCs, license agreements and JVs;
- the ability of our collaborators and licensees to protect our intellectual property and other proprietary rights and technologies;
- our ability and the ability of our collaborators and licensees to develop and successfully commercialize products enabled by our technologies;
- the rate and degree of market acceptance of any products developed by us, our subsidiaries, a collaborator under an ECC or through a JV or license under a license agreement;
- our ability to retain and recruit key personnel;

Table of Contents

- the result of litigation proceedings or investigations that we face currently or may face in the future;
- our expectations related to the use of proceeds from our public offerings and other financing efforts; and
- our estimates regarding expenses, future revenue, capital requirements and needs for additional financing.

Forward-looking statements may also concern our expectations relating to our subsidiaries and other affiliates. We caution you that the foregoing list may not contain all of the forward-looking statements made in this Annual Report. We may not actually achieve the plans, intentions or expectations disclosed in our forward-looking statements, and you should not place undue reliance on our forward-looking statements. Actual results or events could differ materially from the plans, intentions and expectations disclosed in the forward-looking statements we make. We have included important factors in the cautionary statements included in this Annual Report, particularly in Item 1A, "Risk Factors," that could cause actual results or events to differ materially from the forward-looking statements that we make. Our forward-looking statements do not reflect the potential impact of any future acquisitions, mergers, dispositions, JVs or investments that we may make.

You should read this Annual Report, the documents that we reference in this Annual Report, the audited consolidated financial statements and related notes thereto included in this Annual Report and the documents that we have filed as exhibits to our filings with the Securities and Exchange Commission, or SEC, completely and with the understanding that our actual future results may be materially different from what we expect. We do not assume any obligation to update any forward-looking statements, whether as a result of new information, future events or otherwise, except as required by law.

Table of Contents

PART I

Item 1. Business

We believe we are a leader in the field of synthetic biology, focusing on programming biological systems to alleviate disease, remediate environmental challenges, and provide sustainable food and industrial chemicals. At present rates of global industrialization and population growth, food and energy supplies and environmental and healthcare resources are becoming more scarce and/or costly. We believe it is not a viable option for mankind to continue on this path — new solutions will be necessary to preserve and globally expand a high quality of life. We believe that synthetic biology is a solution.

Synthetic biology is a rapidly evolving discipline that applies engineering principles to biological systems to enable rational, design-based control of cellular function for a specific purpose. Using our suite of proprietary and complementary technologies, we design, build and regulate gene programs, which are DNA sequences that consist of key genetic components. A single gene program or a complex, multi-genic program is fabricated and stored within a DNA vector. Vectors are segments of DNA used as a vehicle to transmit genetic information. DNA vectors can, in turn, be introduced into cells in order to generate a simple or complex cellular system, which are the basic and complex cellular activities that take place within a cell and the interaction of those systems in the greater cellular environment. It is these genetically modified cell systems that can be used to produce biological effector molecules, or be employed directly to enable the development of new and improved products and manufacturing processes across a variety of end markets, including health, food, energy, and environment. Our synthetic biology capabilities include the ability to precisely control the amount, location and modification of biological molecules to control the function and output of living cells and optimize for desired results at an industrial scale.

Working with our subsidiaries, JVs, and collaborators, we seek to create more effective, less costly and more sustainable solutions than can be provided through current industry practices. Our technologies combine the principles of precision engineering, statistical modeling, automation and production at an industrial scale. We efficiently engineer precise and complex gene programs across many cell types. We apply the engineering principle of a design-build-test-learn continuum, through which we accumulate knowledge about the characteristics and performance of gene programs and cell lines. This process of continuous learning allows us to enhance our ability to design and build improved and more complex gene programs and cellular systems.

While the field of synthetic biology is still emerging, the addressable markets that may benefit from this approach are large and well-established. In health, synthetic biology may provide new approaches to treating diseases, as well as improvements to the manufacture of existing products. It is estimated that in 2018 the global biopharmaceuticals market was over $237 billion. While genetically modified salmon or tilapia may be considered new products, the global market for aquaculture was estimated at more than $170 billion in 2017. Genetically modified agricultural plants are already grown on approximately 180 million hectares around the world and have a global market value greater than $15 billion. In energy, we are working to create novel, highly engineered bacteria that utilize specific energy feedstocks, typically pipeline grade natural gas, to synthesize commercial end products, such as isobutanol for gasoline blending, 2,3 Butanediol for conversion to synthetic rubber and 1,4 Butanediol for polyester. In aggregate, the value of such fuel and chemical products are significant, representing the potential of billions of dollars in estimated market opportunity.

We believe our technologies are broadly applicable across many diverse end markets. Historically, we built our business primarily around the formation of ECCs. An ECC is an agreement with a collaborator to develop products based on technologies in a specifically defined field. Through our ECCs, we provide expertise in the engineering of gene programs and cellular systems, and our collaborators are responsible for providing market and product development expertise, as well as sales and marketing capabilities. In addition, we have sometimes executed a research collaboration to develop an early-stage program pursuant to which we received reimbursement for our development costs but the exclusive commercial rights, and related access fees, were deferred until completion of an initial research program.

Over time, our strategy has evolved away from ECC-type collaborations to relationships and structures that provide us with more control and ownership over the development process and commercialization path. In these new relationships and structures, we bear more of the responsibility to fund the projects and execute on product candidate

development. For example, in October 2018, through our wholly owned subsidiary, Precigen Therapeutics, Inc., or Precigen, we entered into a license agreement, the ZIOPHARM License Agreement, with ZIOPHARM Oncology, Inc., or ZIOPHARM, which terminated and replaced the terms of an ECC with ZIOPHARM. The ZIOPHARM License Agreement gives us development and commercialization control over certain products previously licensed to ZIOPHARM. Additionally, in December 2018, we reacquired the rights to use Chimeric Antigen Receptor T-cell (CAR-T) technologies that were previously licensed to Ares Trading S.A., a wholly owned subsidiary of Merck KGaA, collectively Merck KGaA. See "Notes to the Consolidated Financial Statements - Note 5" appearing elsewhere in this Annual Report for further discussion.

Table of Contents

In certain strategic circumstances, we may enter into a JV with a third-party collaborator whereby we may contribute access to our technology, cash or both into the JV, which we will jointly control with our collaborator. Pursuant to a JV agreement, we may be required to contribute additional capital to the JV, and we may be able to receive a higher financial return than we would normally receive from an ECC, to the extent that we and our collaborator are successful in developing one or more products. Additionally, we are increasing the resources that we are expending internally on early-stage proof-of-concept programs where we believe we can leverage our competitive edge in gene program creation and host cell and genome expertise. We are also seeking to partner our more mature programs and capabilities or later-stage assets. In this way, we endeavor to leverage our capital resources and ultimately hope to realize significant value from our mature assets.

As we consider the broad potential applications of our synthetic biology technologies, and consistent with the evolution of our business strategy, we have acquired a number of ventures that are already enabling products that benefit from the application of synthetic biology. Our strategy contemplates the continued acquisition of product-focused companies that we believe may leverage our technologies and expertise in order to expand their respective product applications. We believe that the acquisition of these types of companies allows us to develop and commercialize innovative products and create significant value.

Consistent with the ongoing evolution of our strategy, we routinely consider ways to organize our business and the grouping of our assets to facilitate strategic opportunities.

What is synthetic biology?

History

Synthetic biology entails the application of engineering principles to biological systems for the purpose of designing and constructing new biological systems or redesigning/modifying existing biological systems. Biological systems are governed by DNA, the building blocks of gene programs, which control cellular processes by coding for the production of proteins and other molecules that have a functional purpose and by regulating the activities of these molecules. This regulation occurs via complex biochemical and cellular reactions working through intricate cell signaling pathways, and control over these molecules modifies the output of biological systems.

In the early 1970s, scientists utilized basic tools and procedures for transferring DNA from one organism to another. Foundational tools included: gene programs contained in vectors; enzymes that could cut DNA at specific sites; and enzymes that could "glue" two complementary segments of DNA together. Developments between 1980 and the end of the 20th century advanced the field of genetic engineering, including automated DNA sequencing, DNA amplification via polymerase chain reaction and the creation of genetically modified organisms, or GMOs. However, the simplistic "cut-and-paste" nature of the available tools and the absence of genomic sequence information significantly restricted the scope of early synthetic biology efforts.

More recently, synthetic biology has been enabled by the application of information technology and advanced statistical analysis, also known as bioinformatics, to genetic engineering, as well as by improvements in DNA synthesis. Synthetic biology aims to engineer gene-based programs or codes to modify cellular function to achieve a desired biological outcome. For example, applications may include the replacement of a defective protein with a functional protein to treat a broad range of human and animal disease states or the production of multiple proteins through the regulation of several genes in a cell to produce petrochemicals.

Our approach

The essence of our approach is to apply synthetic biology by using an iterative process in which we:

- Design genes of interest and gene programs utilizing knowledge of cellular pathways and protein function;
- Build biological molecules, gene programs and their variants to optimize performance of the biological system;
- Test gene programs by inserting them into cellular systems and comparing the result(s) to the intended effects; and
- Learn by utilizing information gained in our iterative processes to create better gene programs and cellular systems using a more informed and efficient process to achieve improved outcomes.

As a result of our approach, we have developed extensive knowledge about many classes of DNA components and the rules governing their expression and activity. We have also assembled an inventory of these DNA components that we can use to

7

Table of Contents

rationally construct unique vectors with predictable outcomes. The knowledge embedded in our DNA database allows us to create single gene and highly complex multigenic gene programs (an individual gene program containing multiple genes).

To support our approach, we have developed, acquired, and integrated a unique suite of technologies, and we continue to expand upon their capabilities. These technologies are complementary in nature and share some or all of the following key characteristics:

- Platform neutral — outcome oriented. We can work across different cell types with the objective of achieving the intended biological outcome allowing for product development across a broad spectrum of end markets.
- Knowledge driven. We use statistical modeling tools and computational analysis to continually acquire more knowledge about biological systems and their design to continually improve our ability to develop new and improved products and processes.
- Rationally designed. Our knowledge of biological systems and components allows us to design, build and select gene programs.
- Capable of complexity. Our technologies enable the design and precise control of complex biological molecules and multigenic gene programs.
- Industrial scale. We use engineering principles and automation to enable products based on synthetic biology that are commercially viable.

Our competitive strengths

We believe that our technologies, our ability to work across multiple host systems and our approach to synthetic biology — design-build-test-learn — give us a competitive advantage over traditional industrial processes as well as current approaches to synthetic biology.

We believe that we have the following competitive strengths:

We have a suite of proprietary and complementary technologies

We have built a suite of proprietary and complementary technologies that provides us with a comprehensive ability to design, create, modify and regulate gene programs and cellular systems across multiple host systems (human, animal, insect, plant, fungi, and bacteria). By virtue of the complementary nature of our technologies, we are able to provide our subsidiaries, JVs, and collaborators with a diverse array of capabilities to potentially develop and commercialize new and differentiated products enabled by synthetic biology.

Our design-build-test-learn continuum allows us to design and build improved and more complex gene programs

We have developed a core expertise and technologies to design, build and test complex gene programs, as well as technologies to isolate cells that best express the desired biological output. We have also developed an extensive bioinformatic software platform that combines information technology with advanced statistical analysis for DNA design and genetic engineering, enabling us to continually learn and create optimal conditions for our gene programs. Our approach allows us to build improved and more complex gene programs.

We believe we are a leader in synthetic biology

We believe we are the first company focused exclusively on applying synthetic biology across a broad spectrum of end markets and have been working in the field since 1998. Over the last 21 years, we have accumulated extensive knowledge and experience in the design, modification and regulation of gene programs. We believe all of these factors, coupled with our suite of proprietary and complementary technologies, provide us with advantages in synthetic biology.

We serve large and diverse end markets with high built-in demand

A vast number of products consumed globally are or can be produced using biologically-based processes. Natural resources are becoming more scarce as demand exceeds supply, creating unmet needs for improvements in development and manufacturing. As a result, the need for complex biologically engineered molecules such as those enabled by our synthetic biology

Table of Contents

technologies is large and spans multiple industries, including health, food, energy, and environment. Each of these markets faces unique challenges, however all have unmet needs for improvements in product development and manufacturing that can result in savings of both cost and time as compared to traditional means of industrial design and production. Because synthetic biology has the potential to deliver against these unmet needs, we believe that significant demand already exists for improved products enabled by synthetic biology. Additionally, there are markets utilizing traditional industrial processes that have failed to recognize the significant improvement in performance that could be achieved using synthetic biology.

Our evolving business strategy allows us to leverage the broad potential of synthetic biology

We believe our ECC business model was a capital efficient and rapid way for us to initiate our participation in a diversified range of product opportunities and industrial end markets, including health, food, energy, and environment. While our ongoing ECCs continue to allow us to participate in the potential upside from products that are enabled by our technologies across a range of industries, we believe that we are now capable of recognizing additional benefit from the product candidates enabled by our technologies through the formation of a variety of business structures, including operating subsidiaries and JVs. The flexibility of this approach, we believe, will enable us to maximize the value we receive for each particular opportunity within various industries in which we operate.

Our suite of proprietary and complementary technologies

We apply the potential of synthetic biology through our suite of proprietary and complementary technologies that combine the principles of precision engineering, statistical modeling, automation and production at an industrial scale. This enables us to engineer precise and complex gene programs across many cell types.

In order to create a highly functional biological system, we recognize the complexity of cellular processes and the necessity to construct an optimized gene program in conditions reflective of the natural environment to allow for the creation of the optimal biological product. This requires a rigorous understanding of cell signaling pathways as well as the interactions that influence the expression of protein. This knowledge is captured in our advanced Cell Systems Informatics, which uses statistical modeling and other analytic frameworks to determine the most efficient pathways for an intended biochemical result, and also plays a critical role in our research and development as this database of information allows us to explore new targets of potential interest to our current or future subsidiaries, JVs, and collaborators. Moreover, our bioinformatics and computational modeling platform is central to our Protein Engineering, which focuses on designing enhanced and/or novel protein functionalities, including stability, localization, and catalytic activity.

In addition to creating optimized gene programs via the most efficient cell signaling pathways and in the relevant cellular environments, we have a growing library of genetic components with our UltraVector platform that enable design and assembly of gene programs that facilitate control over the quality, function, and performance of living cells. Our RheoSwitch inducible gene switch provides quantitative dose-proportionate regulation of the amount and timing of target protein expression, thereby providing another mechanism to closely control activity of a newly constructed gene program. Further, our AttSite Recombinases allow for stable, targeted gene integration and expression. Once cells have been engineered for the desired biological output, the LEAP automated platform can be used to identify and purify cells of interest, such as antibody expressing cells and stem cells. Furthermore, our ActoBiotics platform allows for targeted in situ expression of proteins and peptides from engineered microbes. Finally, our AdenoVerse technology platform is comprised of engineered adenovector serotypes that alone and in conjunction with our ability to further manipulate and improve the platform permits greater tissue specificity and target selection. We believe this platform will deliver a gene capacity exceeding 30kb which is three to six times greater than current viral delivery methods.

Our markets

Synthetic biology has applicability across many diverse end markets. Our goal is to be a leader in the application of synthetic biology for products currently utilizing biologically-based processes, and a leader in the replacement of conventional processes and products with biologically-based substitutes. Through the application of our suite of proprietary and complementary technologies, we believe we can create optimized biological processes and create substitutes for traditional industrial techniques, leading to improved products that are developed and manufactured faster and more cost-effectively.

Human Health

It is estimated that in 2018 the global biopharmaceuticals market was over $237 billion and is projected to reach greater than $388 billion by 2024. We believe that the unreliable, costly discovery and development process for new medicines is being replaced by the engineering of biology at the genetic, molecular, and cellular level. Our ability to regulate complex gene

Table of Contents

programs and cellular systems by applying the principles of science, engineering, and computational bioinformatics with proprietary technologies is being utilized to design new therapies for humans and animals. We are applying our approach to develop targeted gene therapy applications and novel solutions within oncology, rare diseases, active pharmaceutical ingredients, ocular diseases, and infectious diseases, as well as autoimmune, metabolic, and gastrointestinal disorders. All of our human therapeutic product candidates are in the drug discovery, preclinical, or clinical stages of development.

Food and Agriculture

The Food and Agriculture Organization of the United Nations predicts that by 2050 the world's population will grow to almost 10 billion, global demand for food and other agricultural products is expected to increase 50 percent, and global demand for livestock products will increase by 70 percent. We are focused on enabling efficient, high-quality food production that sustainably supports the necessities of our growing population. By applying our suite of technologies, we aim to facilitate development of agricultural, livestock and aquaculture resources that deliver innovative approaches and superior production yields in an environmentally responsible manner.

Energy and Chemicals

Biological production via precise enzymatic conversion represents a promising approach for the efficient production of important energy products. Despite this promise, current attempts to produce "clean" energy are expensive to implement and operate at near break-even yields despite government assistance. Additionally, many alternative energy initiatives start from food sources, such as corn and sugarcane. As a result, these low efficiency processes also compete for arable land and water with the agriculture industry. Using our cellular engineering experience and suite of technologies, we have developed microbial cell lines for bioconversion of methane to higher carbon content compounds. We believe this proprietary platform holds the potential to modernize the existing gas-to-liquids industry by generating important fuels and chemicals at a fraction of the cost of traditional conversion methods. Our bioconversion approach also is being designed to reach an overall balance between sustainable productive yields and attractive economic returns.

To date we have accomplished biological production on a non-commercial scale of six fuel and chemical products that have promise in valuable and relatively large markets. These product opportunities are isobutanol for gasoline blending, 2,3 Butanediol and isoprene for conversion to synthetic rubber, 1,4 Butanediol for polyester, farnesene for diesel fuel and lubricants and isobutyraldehyde for acrylics. In aggregate, the value of such fuel and chemical products are significant, representing the potential of billions of dollars in estimated market opportunity.

Environment

Increased globalization has facilitated the spread of pests that affect human and environmental health by carrying disease and damaging crops. In addition, increasing agriculture outputs and employing more industrialized processes to meet the demands of a rapidly growing global population can impact natural resources and affect the environment. We seek to engineer biological solutions that are designed to protect, preserve or restore the environment and promote sustainability of natural resources. These biological approaches may replace products and processes that present an environmental hazard. Examples of products under development include biologically-based approaches that displace petroleum-derived ingredients and polymers, reduce the wasteful practices associated with extracting compounds that occur in limiting amounts in plants and animals, enable toxin-free, species-specific insect control with methods that do not persist in the environment, and facilitate improved sustainability in food systems.

Our business strategy

We believe our technologies are broadly applicable across many diverse end markets, including some end markets that have failed to recognize the applicability of synthetic biology or failed to efficiently utilize biologically-based processes to produce products. To enable us to maximize the number of these markets we could address, we devised a strategy that allowed us to focus on our core expertise in synthetic biology while developing many different commercial product candidates via collaborations in a broad range of industries or end markets. We built our business primarily around the formation of ECCs, as well as certain research collaborations.

Over time, our strategy has evolved away from ECC-type collaborations to relationships and structures that provide us with more control and ownership over the development process and commercialization path. In these new relationships and structures, we bear more of the responsibility to fund the projects and execute on product candidate

development.

Table of Contents

For example, effective January 1, 2018, we transferred certain of our gene and cell therapy assets for human health to our wholly owned subsidiary, Precigen. As a further part of this strategic evolution, in October 2018, we entered into the ZIOPHARM License Agreement, which terminated and replaced the terms of an ECC with ZIOPHARM. The ZIOPHARM License Agreement gives us development and commercialization control over certain products previously licensed to ZIOPHARM. Finally, in December 2018, we reacquired the rights to use Chimeric Antigen Receptor T-cell (CAR-T) technologies that were previously licensed to Merck KGaA.

We have acquired a number of ventures that are already enabling products that benefit from the application of synthetic biology. Our strategy contemplates the continued acquisition of product-focused companies that we believe may leverage our technologies and expertise in order to expand their respective product applications. We believe that the acquisition of these types of companies allows us to develop and commercialize innovative products and create significant value.

In certain strategic circumstances, we may enter into a JV with a third party collaborator where we may contribute access to our technology, cash or both into the JV that we will jointly control with our collaborator. Pursuant to a JV agreement, we may be required to contribute additional capital to the JV, and we may be able to receive a higher financial return than we would normally receive from an ECC to the extent that we and our collaborator are successful in developing one or more products. Our gas-to-liquid platform for bioconversion of methane to higher carbon content compounds, which we refer to as our methane bioconversion platform, or MBP, is an example of our implementation of a JV approach. Based on our internally developed work on our MBP technology, we have executed two JV arrangements with related parties for specific end products.

Our operating subsidiaries

To derive value from the broad potential applications of our synthetic biology technologies, and consistent with the evolution of our business strategy, we routinely consider ways to organize our business to facilitate strategic opportunities. For example, we have acquired a number of ventures that are already enabling products that benefit from the application of synthetic biology and that we now operate as subsidiaries. Our strategy contemplates the continued formation and acquisition of such operating subsidiaries. As these enterprises develop, we will determine whether to maintain full ownership, introduce investors via either private or public financing, or seek strategic options to partner or divest the businesses.

Primary wholly owned operating subsidiaries

Precigen, Inc.

Precigen is a dedicated discovery and clinical stage biopharmaceutical company advancing the next generation of gene and cellular therapies using precision technology to target urgent and intractable diseases in immuno-oncology, autoimmune disorders, and infectious diseases. Precigen's technologies and technologies licensed from Intrexon enable Precigen to find innovative solutions for affordable biotherapeutics in a controlled manner. Precigen operates as an innovation engine, progressing a preclinical and clinical pipeline of well-differentiated unique therapies toward clinical proof-of-concept and commercialization.

ActoBio Therapeutics, Inc.

ActoBio Therapeutics, Inc., or ActoBio, is pioneering a new class of microbe-based biopharmaceuticals that enable expression and local delivery of disease-modifying therapeutics. The ActoBiotics platform produces biologics through oral or topical administration with treatment applications across many diseases including oral, gastrointestinal, and autoimmune/allergic disorders. This approach is being developed to provide safer and more efficacious treatments than injectable biologicals. ActoBio, both independently and through an ECC, has a strong research and development pipeline with the latest stage candidate in Phase 2b clinical trials and an extensive portfolio of candidates ready for clinical development across a number of potential indications.

Trans Ova Genetics, L.C.

Trans Ova Genetics, L.C., or Trans Ova, is internationally recognized as a provider of industry-leading bovine reproductive technologies. Intrexon and Trans Ova are building upon Trans Ova's original platform with a goal of achieving higher levels of delivered value to dairy and beef cattle producers. Progentus, L.C., or Progentus, a wholly owned subsidiary of Trans Ova, is a provider of bovine embryos. ViaGen, L.C., or ViaGen, a wholly owned subsidiary of Trans Ova, is a provider of cloning technology for livestock species. Exemplar Genetics, LLC, or

Exemplar, a wholly owned subsidiary through the combined ownership of Trans Ova, ViaGen and us, is committed to enabling the study of life-threatening human diseases through the

Table of Contents

development of miniswine research models and services, as well as enabling the production of cells and organs in its genetically engineered swine for regenerative medicine applications.

Okanagan Specialty Fruits, Inc.

Okanagan Specialty Fruits, Inc. and its affiliates, or Okanagan, is the pioneering agricultural company behind the world's first non-browning apple without the use of any artificial additives. Okanagan is scaling up its commercial supplies of non-browning apples and developing new commercial tree fruit varieties intended to provide benefits to the entire supply chain, from growers to consumers.

Oxitec Limited

Oxitec Limited, or Oxitec, is a pioneering company in biological insect control solutions. Oxitec is developing products that use genetic engineering to control insect pests that spread disease and damage crops. Among the applications of its platform, which uses advanced genetics and molecular biology, Oxitec has developed innovative solutions for controlling Aedes aegypti, a mosquito that is a known vector for the transmission of infectious disease including dengue fever, chikungunya, and Zika and, in conjunction with its collaborators, is pursuing solutions that target certain agricultural crop pests. Oxitec is pursuing regulatory and commercial approvals for its insect solutions in a number of countries, including the United States.

Primary majority-owned operating subsidiary

AquaBounty Technologies, Inc.

AquaBounty Technologies, Inc., or AquaBounty, is focusing on improving productivity in commercial aquaculture, including the development of the AquAdvantage Salmon, or AAS, an Atlantic salmon that has been genetically enhanced to reach market size in less time than conventionally farmed Atlantic salmon and approved by the Food and Drug Administration, or FDA. As of December 31, 2018, we owned approximately 55 percent of AquaBounty. In the future, our ownership stake in AquaBounty may drop below 50 percent, which may result in our deconsolidating AquaBounty.

Joint ventures

The following represent our significant JVs as of December 31, 2018:

Intrexon Energy Partners

In March 2014, we and certain investors, or the IEP Investors, including affiliates of Third Security, LLC, or Third Security, a related party, entered into a Limited Liability Company Agreement that governs the affairs and conduct of business of Intrexon Energy Partners, LLC, or Intrexon Energy Partners, a JV formed to optimize and scale-up our MBP technology for the production of certain fuels and lubricants. We also entered into an ECC with Intrexon Energy Partners providing exclusive rights to our technology for the use in bioconversion, as a result of which we received a technology access fee of $25 million while retaining a 50 percent membership interest in Intrexon Energy Partners. The IEP Investors made initial capital contributions, totaling $25 million in the aggregate, in exchange for pro rata membership interests in Intrexon Energy Partners totaling 50 percent. We committed to make additional capital contributions of up to $25 million, and the IEP Investors, as a group and pro rata in accordance with their respective membership interests in Intrexon Energy Partners, have committed to make additional capital contributions of up to $25 million, at the request of the Intrexon Energy Partners' board of managers, or the Intrexon Energy Partners Board, and subject to certain limitations. Intrexon Energy Partners is governed by the Intrexon Energy Partners Board, which has five members. Two members of the Intrexon Energy Partners Board are designated by us and three members are designated by a majority of the IEP Investors. We and the IEP Investors have the right, but not the obligation, to make additional capital contributions above the initial limits when and if solicited by the Intrexon Energy Partners Board.

Intrexon Energy Partners II

In December 2015, we and certain investors, or the IEPII Investors, entered into a Limited Liability Company Agreement that governs the affairs and conduct of business of Intrexon Energy Partners II, LLC, or Intrexon Energy Partners II, a JV formed to utilize our MBP technology for the production of 1,4-butanediol, an industrial chemical intermediate used to manufacture spandex, polyurethane, plastics, and polyester. We also entered into an ECC with Intrexon Energy Partners II providing exclusive rights to our technology for use in the field, as a result of which we received a technology access fee of $18 million while retaining a 50 percent membership interest in Intrexon Energy Partners II. The IEPII Investors made initial capital

12

Table of Contents

contributions, totaling $18 million in the aggregate, in exchange for pro rata membership interests in Intrexon Energy Partners II totaling 50 percent. In December 2015, the owners of Intrexon Energy Partners II made a capital contribution of $4 million, half of which was paid by us. We committed to make additional capital contributions of up to $10 million, and the IEPII Investors, as a group and pro rata in accordance with their respective membership interests in Intrexon Energy Partners II, have committed to make additional capital contributions of up to $10 million, at the request of the Intrexon Energy Partners II's board of managers, or the Intrexon Energy Partners II Board, and subject to certain limitations. Intrexon Energy Partners II is governed by the Intrexon Energy Partners II Board, which has five members. One member of the Intrexon Energy Partners II Board is designated by us and four members are designated by a majority of the IEPII Investors. We and the IEPII Investors have the right, but not the obligation, to make additional capital contributions above the initial limits when and if solicited by the Intrexon Energy Partners II Board.

EnviroFlight

In February 2016, we entered into a series of transactions involving EnviroFlight, LLC, or Old EnviroFlight, Darling Ingredients Inc., or Darling, and a newly formed venture between us and Darling, or New EnviroFlight. This series of integrated transactions resulted in us acquiring substantially all of the assets of Old EnviroFlight and contemporaneously contributing all of these assets, with the exception of certain developed technology, and $3 million of cash to New EnviroFlight in exchange for a non-controlling, 50 percent membership interest in New EnviroFlight. Our contributions to New EnviroFlight included an exclusive license to the developed technology that was retained by us. Darling received the remaining 50 percent membership interest in New EnviroFlight as consideration for terminating rights previously held in the developed technology with Old EnviroFlight. New EnviroFlight was formed to generate high nutrition, low environmental impact animal and fish feed, as well as fertilizer products, from black soldier fly larvae.

See "Notes to the Consolidated Financial Statements - Note 5" appearing elsewhere in this Annual Report for a discussion of significant collaborations between us and our JVs.

Our ECCs

Although our strategy has evolved away from a focus primarily on ECCs, we remain party to a number of such collaborations, and we may, in the future, elect to enter into additional ECCs or expand one or more of our existing ECCs. An ECC is an agreement with a collaborator to develop products based on our technologies in one or more specifically defined fields. These fields may be narrowly defined (representing, for example, a specific therapeutic approach for a single indication) or may be broad (representing, for example, an entire class of related products). In each case, we and the collaborator precisely define the field based on factors such as the expertise of the collaborator, the relative markets for the prospective products, the collaborator's resources available to commit to the ECC and our expectations as to other prospective ECCs in related areas. Regardless of the size of the field, under each ECC we grant the collaborator exclusive rights to our services and certain of our technologies to commercialize products within the field.

We may realize four general categories of revenue under our ECCs: (i) technology access fees upon signing; (ii) reimbursements of costs incurred by us for our research and development and/or manufacturing efforts related to specific applications provided for in the collaboration; (iii) milestone payments upon the achievement of specified development, regulatory and commercial activities; and (iv) royalties on sales of products arising from the collaboration. We may receive equity in lieu of cash for technology access fees and milestones and also may participate in capital raises to allow earlier-stage collaborators to focus their resources on product development.

Generally, each of our ECCs is designed to continue in perpetuity unless terminated. Each of our collaborators, however, retains the right to terminate the ECC for any reason by providing us written notice a certain period of time prior to such termination, generally ninety days. The ECC is also terminable by either party upon the other party's breach of material provisions of the ECC. The failure of our collaborator to exercise diligent efforts to develop products within the field of the ECC constitutes such a breach.

In the event one of our ECCs terminates, we are entitled to immediately pursue a collaboration with a different counterparty within the field of the terminated ECC. Moreover, technologies and product candidates in a relatively early stage of development revert to us, along with data, materials and the rights to applicable regulatory filings

related to the reverted products, enabling us to develop those product candidates ourselves or incorporate them into a future collaboration. Product candidates that are at a more advanced stage of development, such as those already generating revenue or being considered for approval by an applicable regulatory body at the time of the ECC's termination are retained by the former collaborator. The collaborator has the right to commercialize such retained products although we are entitled to the royalties or other

Table of Contents

compensation to which we would be entitled as if the ECC were still in effect. Upon termination, we generally retain any technology access fees or other payments to which we are entitled through the date of termination.

In our ECCs, we retain rights to our existing intellectual property and generally any intellectual property developed using, or otherwise incorporating, our technologies. In addition, we are generally responsible for controlling the prosecution and enforcement of this intellectual property with the exception of the enforcement of patents directed solely and specifically to products developed within the field of each ECC.

Each of our ECCs requires the collaborator to indemnify us for all liability related to products produced pursuant to the ECC and to obtain insurance coverage related to product liability.

See "Notes to the Consolidated Financial Statements - Note 5" appearing elsewhere in this Annual Report for a discussion of the key financial terms of our significant ECCs.

Mergers, acquisitions, and technology in-licensing

We may augment our suite of proprietary technologies through mergers or acquisitions of technologies, which would then become available to new or existing ventures, including operating subsidiaries, JVs, and collaborations. Among other things, we may pursue technologies that we believe will be generally complementary to our existing technologies and also meet our desired return on investment and other economic criteria. In certain cases, such technologies may already be applied in the production of products or services and in these cases we may seek to expand the breadth or efficacy of such products or services through the use of our technologies. See "Notes to the Consolidated Financial Statements - Note 3" appearing elsewhere in this Annual Report for further discussion of mergers, acquisitions or significant technology in-licensing activities.

Competition

We believe that we are a leader in synthetic biology. We do not believe that we have any direct competitors who provide similar technologies that fully enable the commercialization of products developed using synthetic biology across a broad spectrum of biologically-based industries. As a result, we believe our competition is more indirect and general in nature and falls into three broad categories:

- Synthetic biology service providers. There are companies that have competing technologies for individual pieces of our suite of complementary technologies. For example, there are companies that can synthesize DNA, and there are companies that can develop monoclonal antibodies. One portion of our proprietary technology related to DNA synthesis and assembly includes the ability to de novo synthesize DNA. We believe the following companies engage in the manufacture of DNA componentry: ATUM, Inc.; Blue Heron Biotech, LLC (a subsidiary of OriGene); Integrated DNA Technologies, Inc. (IDT); GenScript USA, Inc.; Life Technologies Corporation, now part of Thermo Fisher Scientific Inc.; and Twist Bioscience Corporation.
- Industrial companies who may develop their own approach to synthetic biology. Rather than becoming a collaborator with us, potential collaborators may decide to invest time and capital to internally develop their own synthetic biology capabilities. For example, large biopharmaceutical companies, energy companies, and ag-bio companies may pursue a proprietary synthetic biology strategy.
- Industrial companies who may develop competing products using other technologies. Products enabled by our synthetic biology will face competition in the market, including from products that have been developed using other industrial technologies. For example, large biopharmaceutical companies pursue other technologies for drug development, and large ag-bio companies pursue other technologies for the development of genetically modified crops. The rapidly evolving market for developing genetically engineered, or GE, T-cells in particular is characterized by intense competition and rapid innovation. Genetically engineering T-cells faces significant competition in the chimeric antigen receptor, or CAR, technology space from multiple companies and their collaborators, such as Novartis/University of Pennsylvania, Bluebird Bio/Celgene/Juno Therapeutics, Gilead/Kite Pharma, Cellectis, Allogene Therapeutics, Adaptimmune/GSK, Autolus Therapeutics, and Bellicum Pharmaceuticals. We face competition from non-cell based treatments offered by other companies such as Amgen, AstraZeneca, Bristol-Myers Squibb, Incyte, Merck, and Roche.

Table of Contents

Intellectual property

As we advance technologies across multiple platforms and synthetic biology areas, correspondingly, we apply a multilayered approach for protecting intellectual property relating to the inventions we have developed internally as well as those we have acquired from third parties, such as by assignment or by in-license. We seek patent protection in the United States and in other countries for our inventions and discoveries, and we develop and protect our key know-how and trade secrets relating to our platform technologies as well as to the products we are developing with our subsidiaries, JVs, and collaborations.

We seek patent protection for our platform technologies, including but not limited to our (i) switch technology; (ii) activator ligands for our switch technology; (iii) portfolio around various genetic componentry such as vectors, cells and organisms containing these genetic componentry; and (iv) cell identification and selection platform. In addition, we seek patents covering specific collaborator's products.

Through the use of our various platform technologies we seek to design and build proprietary compounds, vectors, methods and processes across a variety of end markets. In particular, we focus our intellectual property on synthetic biology technologies that provide platforms for the design and creation of cells, vectors and components for our subsidiaries, JVs, and collaborations. In addition, we may pursue intermediate and product-specific patents associated with our subsidiaries', JVs', and collaborations' lead programs.

Our success depends, in part, upon our ability to obtain patents and maintain adequate protection for our intellectual property relating to our technologies and products and potential products. We have adopted a strategy of seeking patent protection in the United States and in other jurisdictions globally as we deem appropriate under the circumstances, with respect to certain of the technologies used in or relating to our products and processes. For instance, where we believe appropriate, we have also filed counterpart patents and patent applications in other jurisdictions, including Australia, Argentina, Brazil, Canada, China, Europe, Hong Kong, India, Indonesia, Israel, Japan, Korea, Mexico, New Zealand, Philippines, Russia, Singapore, South Africa and Taiwan. In the future we may file in these or additional jurisdictions as deemed appropriate for the protection of our technologies.

As of December 31, 2018, we owned at least 55 issued United States patents and 55 pending United States patent applications relating to certain aspects of our technologies, and we have pursued counterpart patents and patent applications in other jurisdictions around the world, as we have deemed appropriate. We continue to actively develop our portfolio through the filing of new patent applications, provisional and continuations or divisionals relating to our technologies, methods and products as we and our collaborators deem appropriate.

We have strategic positioning with respect to our key technologies including our owned patent portfolios directed to: our switch technology covering aspects of our switches and gene modulation systems, with a last to expire patent currently in 2032; our portfolio around various genetic componentry, such as vectors, cells and organisms containing these genetic componentry, and their use, with a last to expire patent in 2034; our activator ligand technology covering aspects of our activator ligands and their use, with a last to expire patent in 2034; and our cell identification and selection technology covering aspects of our cell identification and selection platform, including our cell purification, isolation, characterization and manipulation technologies, with a last to expire patent in 2031. Although we cannot be assured that these patents may not be subject to challenge in the future, as of this filing, there are currently no material contested proceedings and/or third party claims with respect to any of these patent portfolios.

Additionally, we complement our intellectual property portfolio with exclusive and non-exclusive patent licenses and options for licenses to third-party technologies.

A principal component of our strategy is maximizing the value of our ECCs through our intellectual property that covers our technologies, which is accentuated by intermediate and program-specific intellectual property protections. In addition to owned and in-licensed patents, we solidify our intellectual property protection through a combination of trade secrets, know-how, confidentiality, nondisclosure and other contractual provisions, and security measures to protect our confidential and proprietary information related to each platform and collaborator program. We regularly assess and review the risks and benefits of protecting our developments through each aspect of intellectual property available to us.

Because we rely on trade secrets, know-how and continuing technological advances to protect various aspects of our core technology, we require our employees, consultants and scientific collaborators to execute confidentiality and

invention assignment agreements with us to maintain the confidentiality of our trade secrets and proprietary information. Our confidentiality agreements generally provide that the employee, consultant or scientific collaborator will not disclose our confidential information to third parties. These agreements also provide that inventions conceived by the employee, consultant

Table of Contents

or scientific collaborator in the course of working for us will be our exclusive property. Additionally, our employees agree to take certain steps to facilitate our assertion of ownership over such intellectual property. These measures may not adequately protect our trade secrets or other proprietary information. If they do not adequately protect our rights, third parties could use our technologies, and we could lose any competitive advantage we may have. In addition, others may independently develop similar proprietary information or techniques or otherwise gain access to our trade secrets, which could impair any competitive advantage we may have.

Regulatory environment

Regulations affecting Intrexon

With our diverse portfolio of proprietary and complementary technologies cutting across human health, animal health, public health and energy sectors, we are subject to significant and diverse regulations governing research, operations and product approval. Regulatory compliance is critical to our ability to operate, our management of potential liabilities and ultimately, our freedom to sell our products. Moreover, and as discussed below and in "Risk factors - Risks associated with our business strategy," the products produced by us and our collaborators enabled by our technology platforms are subject to extensive regulation. While we and our subsidiaries maintain regulatory compliance practices, we rely on our collaborators' compliance with laws and regulations applicable to the products they produce. We do not independently monitor whether our collaborators comply with applicable laws and regulations. Please see the risk factor entitled "Markets in which we, our JVs, and collaborators are developing products using our technologies are subject to extensive regulation, and we rely on our JVs and collaborators to comply with all applicable laws and regulations."

Environmental regulations affecting Intrexon, our JVs and our collaborators

We, as well as our JVs and collaborators, are subject to various federal, state and local environmental laws, rules and regulations, including those relating to the discharge of materials into the air, water and ground, the generation, storage, handling, use, transportation and disposal of hazardous materials and the health and safety of employees with respect to laboratory activities required for the development of products and technologies. These laws and regulations require us and our JVs and collaborators to obtain environmental permits and comply with numerous environmental restrictions. These laws and regulations also may require expensive pollution control equipment or operational changes to limit actual or potential impacts to the environment.

Our laboratory activities and those of our JVs and collaborators inherently involve the use of potentially hazardous materials, which are subject to health, safety and environmental regulations. We design our infrastructure, procedures and equipment to meet our obligations under these regulations. We perform recurring internal and third-party audits and provide employees ongoing training and support, as required. All of our employees must comply with safety instructions and procedures, which are codified in our employment policies. Federal and state laws and regulations impose requirements on the production, importation, use and disposal of chemicals and genetically-modified microorganisms, or GMMs, which impact us and our JVs and collaborators. Our, our JVs' and our collaborators' processes may contain GE organisms which, when used in industrial processes, are considered new chemicals under the Toxic Substances Control Act, or TSCA, program of the United States Environmental Protection Agency, or EPA. These laws and regulations would require us, our JVs and collaborators to obtain and comply with the EPA's Microbial Commercial Activity Notice process to operate. In the European Union, we and our JVs and collaborators may be subject to a chemical regulatory program known as REACH (Registration, Evaluation, Authorization and Restriction of Chemical Substances). Under REACH, companies are required to register their products with the European Commission, and the registration process could result in significant costs or delay the manufacture or sale of products in the European Union.

Regulations affecting us and our collaborators

Human therapeutics regulation

Government authorities in the United States, at the federal, state and local level, and in other countries extensively regulate, among other things, the research, development, testing, manufacture, including any manufacturing changes, packaging, storage, recordkeeping, labeling, advertising, promotion, distribution, marketing, import and export of pharmaceutical products such as those being developed by our collaborators. The processes for obtaining regulatory approvals in the United States and in foreign countries, along with subsequent compliance with applicable statutes,

regulations, and requirements imposed by regulatory agencies, require the expenditure of substantial time and financial resources.

In the United States, pharmaceuticals must receive approval from the FDA before being marketed. The FDA approves drug products other than biological products through its authority under the Federal Food, Drug, and Cosmetic Act, or FDCA, and

Table of Contents

implementing regulations. The FDA licenses biological drug products, or biologics, through its authority under the Public Health Service Act, or PHSA, and implementing regulations. The development processes for obtaining FDA approval for a non-biological drug product under the FDCA and for biologic licensure under the PHSA are generally similar, but have product-related differences reflected in regulations and in FDA guidance documents.

United States pharmaceutical development process

The process required by the FDA before a pharmaceutical product candidate may be marketed generally involves the following:

- completion of preclinical laboratory tests and in vivo studies in accordance with the FDA's current Good Laboratory Practice regulations and standards, and other applicable requirements;
- submission to the FDA of an Investigational New Drug application, or IND, for human clinical testing, which must become effective before human clinical trials commence;
- performance of adequate and well-controlled human clinical trials according to the FDA's Good Clinical Practices, or GCP, regulations, and any additional requirements for the protection of human research subjects and their health information, to establish the safety and efficacy of the proposed product candidate for each intended use;
- preparation and submission to the FDA of an application for marketing approval that includes substantial evidence of safety, purity and potency for a biologic, or of safety and efficacy for a non-biologic drug, including from results of nonclinical testing and clinical trials;
- satisfactory completion of an FDA inspection of the manufacturing facility or facilities where the product candidate is produced to assess compliance with current Good Manufacturing Practice, or cGMP, and to assure that the facilities, methods and controls are adequate to preserve the product candidate's identity, safety, strength, quality, potency and purity;
- potential FDA inspection of the nonclinical and clinical trial sites that generated the data in support of the application; and
- FDA review and approval of the application.

Human clinical trials under an IND

Clinical trials involve administering the product candidate to healthy volunteers or patients under the supervision of qualified investigators. Clinical trials must be conducted and monitored in accordance with the FDA's regulations. Further, each clinical trial must be reviewed and approved by an Institutional Review Board, or IRB, at or servicing each institution at which the clinical trial will be conducted. An IRB is charged with protecting the welfare and rights of trial participants and considers, among other things, whether the risks to individuals participating in the clinical trials are minimized and are reasonable in relation to anticipated benefits. Clinical trials involving recombinant DNA at institutions that receive any funding from the National Institutes of Health, or NIH, also must be reviewed by an institutional biosafety committee, an institutional committee that reviews and oversees basic and clinical research that utilizes recombinant DNA at that institution.

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

- Phase 1. The product candidate is introduced into healthy human subjects and tested for safety, dosage tolerance, absorption, metabolism, distribution, excretion and, if possible, to gain early understanding of its effectiveness. For some product candidates for severe or life-threatening diseases, especially when the product candidate may be too inherently toxic to ethically administer to healthy volunteers, the initial human testing is often conducted in patients with the targeted disease.
- Phase 2. The product candidate is administered and evaluated in a limited patient population to identify possible adverse effects and safety risks, to evaluate preliminary efficacy evidence for specific targeted diseases and to determine dosage tolerance, optimal dosage and dosing schedule.
- Phase 3. The product candidate is administered to an expanded patient population, often at geographically dispersed clinical trial sites, in adequate and well-controlled clinical trials to generate sufficient data to evaluate the safety and

Table of Contents

efficacy of the non-biologic drug, or the safety, purity, and potency of the biologic. These clinical trials are intended to establish the overall risk/benefit ratio of the product candidate and provide an adequate basis for product labeling. Post-approval clinical trials, sometimes referred to as Phase 4 clinical trials, may be conducted, or may be required to be conducted, after initial approval to further assess the risk/benefit profile of the product and to gain additional experience from treatment of patients in the intended indication, including for long-term safety follow-up.

Additional regulation for gene therapy clinical trials

Additional standards apply to clinical trials involving gene therapy. The FDA has issued guidance documents regarding gene therapies, which relate to, among other things: preclinical assessments; chemistry, manufacturing and controls, or CMC, information that should be included in an IND application; the proper design of tests to measure product potency in support of an application; and measures to observe delayed adverse effects in subjects exposed to investigational gene therapies when the risk of such effects is high.

Compliance with cGMP requirements

Drug and biologics manufacturers must comply with applicable cGMP regulations. Manufacturers and others involved in the manufacture and distribution of such products also must register their establishments with the FDA and certain state agencies. Both domestic and foreign manufacturing establishments must register and provide additional information to the FDA upon their initial participation in the manufacturing of drugs. Establishments may be subject to periodic, unannounced inspections by the FDA and other government authorities to ensure compliance with cGMP requirements and other laws. Discovery of problems may result in a government entity placing restrictions on a product, manufacturer or holder of an approved product, and may extend to requiring withdrawal of the product from the market.

United States review and approval processes

The results of the preclinical tests and clinical trials, together with detailed information relating to the product's CMC and proposed labeling, among other things, are submitted to the FDA as part of an application requesting approval to market the product for one or more uses, or indications. For gene therapies, selecting patients with applicable genetic defects is often a necessary condition to effective treatment and may require diagnostic devices that the FDA has cleared or approved prior to or contemporaneously with approval of the gene therapy.

Under the Pediatric Research Equity Act, or PREA, marketing applications generally must contain data to assess the safety and effectiveness of the biologic product candidate for the claimed indications in all relevant pediatric subpopulations and to support dosing and administration for each pediatric subpopulation for which the product candidate is safe and effective. The FDA may grant deferrals for submission of data or full or partial waivers. Unless otherwise required by regulation, PREA does not apply to any product candidate for an indication for which orphan designation has been granted.

On the basis of the marketing application and accompanying information, including the results of the inspection of the manufacturing facilities, the FDA may issue an approval letter or a complete response letter. An approval letter authorizes commercial marketing of the drug with specific prescribing information for specific indications. A complete response letter generally outlines the deficiencies in the submission and may require substantial additional testing or information for the FDA to reconsider the application. If those deficiencies have been addressed to the FDA's satisfaction in a resubmission of the application, the FDA may issue an approval letter.

If a product candidate receives regulatory approval, the approval may be significantly limited to specific diseases and dosages or the indications for use may otherwise be limited. Further, the FDA may require that certain contraindications, warnings or precautions be included in the product labeling. The FDA may impose restrictions and conditions on product distribution, prescribing or dispensing in the form of a Risk Evaluation and Mitigation Strategy, or REMS, or otherwise limit the scope of any approval. In addition, the FDA may require post-marketing clinical trials designed to further assess a non-biologic drug's safety and effectiveness, or a biologic's safety, purity, and potency, and testing and surveillance programs to monitor the safety of approved products that have been commercialized.

Orphan Drug Designation in the United States

Under the Orphan Drug Act, the FDA may grant orphan drug designation to drugs and biological products intended to treat a "rare disease or condition," which generally is a disease or condition that affects fewer than 200,000 individuals

in the United States. Orphan drug designation must be requested before submitting a marketing application or supplement seeking approval

Table of Contents

for the orphan indication. After the FDA grants orphan drug designation, the common identity of the therapeutic agent and its potential orphan use are publicly disclosed by the FDA.

Orphan drug designation does not—by itself—convey any advantage in, or shorten the duration of, the regulatory review and approval process. If a product that has an orphan drug designation subsequently receives the first FDA approval for that drug or biologic for the indication for which it has been designated, the product is entitled to an orphan exclusivity period in which the FDA may not approve any other applications to market the same drug or biologic for the same indication for seven years.

Exceptions to the seven-year exclusivity period may apply in limited circumstances, such as where the sponsor of a different version of the product is able to demonstrate that its product is clinically superior to the approved orphan drug product. This exclusivity does not prevent a competitor from obtaining approval to market a different product that treats the same disease or condition, or the same product to treat a different disease or condition. The FDA can revoke a product's orphan drug exclusivity under certain circumstances, including when the holder of the approved orphan drug application is unable to assure the availability of sufficient quantities of the drug to meet patient needs. Orphan exclusivity operates independently from other regulatory exclusivities and other protections against generic or biosimilar competition.

A sponsor of a product application that has received an orphan drug designation is also granted tax incentives for clinical research undertaken to support the application. In addition, the FDA will typically coordinate with the sponsor on research study design for an orphan drug and may exercise its discretion to grant marketing approval on the basis of more limited product safety and efficacy data than would ordinarily be required, based on the limited size of the applicable patient population.

Fast Track Designation

The FDA has a number of expedited review programs for drugs that are intended for the treatment of a serious or life-threatening condition. As one example, under the agency's Fast Track program, the sponsor of a new drug candidate may request the FDA to designate the product for a specific indication as a Fast Track product concurrent with or after the filing of the IND for the product candidate. The FDA must determine if the product candidate qualifies for Fast Track designation within 60 days after receipt of the sponsor's request.

In addition to other benefits, such as the ability to have more frequent interactions with the FDA, the agency may initiate review of sections of a Fast Track product's marketing application before the application is complete. This rolling review is available if the applicant provides and the FDA approves a schedule for the submission of the remaining information and the applicant pays applicable user fees. However, the FDA's review period for a Fast Track application does not begin until the last section of the marketing application is submitted. In addition, the Fast Track designation may be withdrawn by the FDA if the agency believes that the designation is no longer supported by data emerging in the clinical trial process.

Post-approval requirements

Rigorous and extensive FDA regulation of drugs and biologics continues after approval, including requirements relating to recordkeeping, periodic reporting, product sampling and distribution, adverse experiences with the product, cGMP, and advertising and promotion. Changes to the manufacturing process or facility often require prior FDA approval before being implemented and other types of changes to the approved product, such as adding new indications and additional labeling claims, are also subject to further FDA review and approval. Failure to comply with the applicable requirements may result in administrative, judicial, civil or criminal actions and adverse publicity. These include refusal to approve pending applications or supplemental applications, withdrawal of approval, clinical hold, suspension or termination of clinical trial, warning or untitled letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines or other monetary penalties, refusals of government contracts, mandated corrective advertising or communications with healthcare providers, debarment, restitution, disgorgement of profits or other civil or criminal penalties.

Regulatory Exclusivity and Biosimilar Competition in the United States

In 2010, the federal Biologics Price Competition and Innovation Act, or BPCIA, was enacted, creating a statutory pathway for licensure, or approval, of biological products that are biosimilar to, and possibly interchangeable with, reference biological products licensed under the Public Health Service Act.

Under the BPCIA, innovator manufacturers of original biological products are granted 12 years of exclusive use after first licensure before biosimilar versions of such products can be licensed for marketing in the United States. This means that the FDA may not approve an application for a biosimilar product that references data in an innovator's Biologics License

Table of Contents

Application, or BLA, until 12 years after the date of approval of the reference biological product, with a potential six-month extension of exclusivity if certain pediatric studies are conducted and the results are reported to the FDA. A biosimilar application may be submitted four years after the date of licensure of the reference biological product, but the FDA cannot approve the application until the full exclusivity period has expired. This 12-year exclusivity period operates independently from other protections that may apply to biosimilar competitors, including patents that are held for those products. Additionally, the BPCIA establishes procedures by which the biosimilar applicant must provide information about its application and product to the reference product sponsor, and by which information about potentially relevant patents is shared and litigation over patents may proceed in advance of approval. The BPCIA also provides a period of exclusivity for the first biosimilar to be determined by the FDA to be interchangeable with the reference product.

Under the Best Pharmaceuticals for Children Act, which was subsequently made applicable to biological products by the BPCIA, the FDA may also issue a Written Request asking a sponsor to conduct pediatric studies related to a particular active moiety; if the sponsor agrees and meets certain requirements, the sponsor may be eligible to receive an additional six months of marketing exclusivity for its drug product containing such active moiety.

Other regulatory exclusivity may be granted to drugs, including, but not limited to, three-year and five-year exclusivity granted to non-biologic drugs under the Drug Price Competition and Patent Term Restoration Act of 1984, also referred to as the Hatch-Waxman Amendments.

Depending upon the timing, duration and specifics of FDA approval of product candidates, some of a sponsor's United States patents may be eligible for limited patent term extension under the Hatch-Waxman Amendments. The Hatch-Waxman Amendments permit a patent restoration term of up to five years as compensation for patent term lost during product development and the FDA regulatory review process. However, patent term restoration cannot extend the remaining term of a patent beyond a total of 14 years from the product's approval date. The United States Patent and Trademark Office, or USPTO, in consultation with the FDA, reviews and approves the application for any patent term extension or restoration. Only one patent applicable to an approved biologic product is eligible for the extension and the application for the extension must be submitted prior to the expiration of the patent.

Foreign regulation of human therapeutics

In addition to regulations in the United States, our subsidiaries, such as Precigen and ActoBio, and our collaborators that are focused on the development of human therapeutic products will be subject to a variety of foreign regulations governing clinical trials and commercial sales and distribution of the products enabled by our technologies. Whether or not the developer obtains FDA approval for a product, they must obtain approval by the comparable regulatory authorities of foreign countries or economic areas, such as the European Union, before they may commence clinical trials or market products in those countries or areas. The approval process and requirements governing the conduct of clinical trials, product licensing, pricing and reimbursement vary greatly from place to place, and the time may be longer or shorter than that required for FDA approval.

Regulation of animal based technologies

The development, movement and commercialization of animal based products (genetically modified animals) is governed globally by either technology- or product-based laws and regulations specific to each country. In the majority of our target markets, the relevant regulatory pathway for animal based products is distinct from those governing human pharmaceutical products although the risk assessment parameters and agencies with jurisdiction may be consistent. In each case, product evaluation and approval requires the development of data to demonstrate human/animal safety, environmental safety and effectiveness. In the United States, the FDA's Center for Veterinary Medicine regulates certain GE animals as 'animal drugs' as well as animal feed products. The United States Department of Agriculture, or USDA, regulates veterinary vaccines and other biologics, and the EPA regulates certain animals, such as genetically modified insects with pesticidal properties, as biopesticides. Regulatory oversight and jurisdiction within the United States is based on either the nature of the product and/or product end use. For example, the FDA has historically regulated genetically modified animals as animal drugs on the basis that the rDNA construct in a GE animal is an article intended to affect the structure or function of the body of the animal and, in some cases, intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in the animal. However, the FDA recently clarified that certain genetically modified animals will not be regulated as animal drugs based on their

ultimate end use. Specifically, products intended to reduce the population of mosquitoes (for example, by killing them at some point in their life cycle, or by interfering with their reproduction or development) are regulated as pesticides by EPA.

Specific statutes and regulations also define standards and data requirements that we and our collaborators must satisfy. While regulatory oversight may vary globally, animal based products generally must undergo regulatory review and approval prior to their movement and commercial introduction internationally. These regulations also require the development and submission of

Table of Contents

data to demonstrate product efficacy as well as evaluate potential risk to human/animal health and the environment. For drugs administered to animals, extensive regulatory requirements exist often including evaluation by the same (or similar) authorities as human pharmaceuticals. For example, a new animal drug is deemed "unsafe" and, therefore, may not be introduced into commerce in the United States unless: the FDA has approved a new animal drug application, or NADA, for its intended use; the drug is only for investigational use and conforms to specified exemptions for such use under an Investigational New Animal Drug, or INAD, exemption; or the drug conforms to certain FDA regulations. The NADA approval process is in many ways similar to the approval process for human drugs and requires a demonstration of the drug's safety and efficacy for its proposed conditions of use. Actions on INADs may require preparation of an environmental assessment, or EA, and a finding of no significant impact, or FONSI. Through the preparation of an EA/FONSI or an Environmental Impact Statement, the FDA will examine the potential for environmental impacts, including the potential for inadvertent release or escape of the animal with an intentionally altered genome and/or its products into the environment, and whether certain measures may mitigate any potential significant impacts that would adversely affect the human environment.

The complex, multi-faceted regulation of genetically modified animals as "animal drugs" is exemplified by the regulatory approval of AquaBounty's AAS, the first genetically modified animal ever approved by the FDA. For such bioengineered animals, the United States and Canada have established regulatory processes led by the FDA and Health Canada/Canadian Food Inspection Agency, or CFIA, respectively, while other countries, such as Brazil and Argentina among others, are using existing authorities for the evaluation of genetically modified organisms for the advancement and regulation of novel genetically modified animal technologies. In December 2012, the FDA published an EA for AAS along with its FONSI in the Federal Register, confirming that an approval of the pending NADA would not have an adverse effect on the environment and opened up a 60 day period for public comment. In February 2013, the FDA extended the period for public comment by an additional 60 days, which expired in April 2013. Prior to the publication of the EA and FONSI, in September 2010, the FDA held a public meeting of its Veterinary Medicine Advisory Committee to review its findings regarding AAS. The conclusion of its panel of experts was that AAS is indistinguishable from other farmed Atlantic salmon, is safe to eat and does not pose a threat to the environment under its conditions of use. Subsequently, the FDA initiated an EA in compliance with its obligations under the National Environment Policy Act, or NEPA, which requires that all federal agencies consider the possible environmental impacts of any action that they authorize. Subsequently, in November 2015, the FDA approved the NADA for the production, sale and consumption of AAS. AquaBounty is subject to on-going post approval responsibilities as detailed in the FDA letter of approval and summarized in the EA dated in November 2015. In the event that AquaBounty seeks to modify or expand its production sites and methods, such would require further regulatory approvals.

In May 2016, Health Canada concluded its review of AAS and approved it for commercial sale in Canada, and the Animal Feed Division of the Animal Health Directorate of CFIA authorized AAS for use in livestock feeds.

In April 2016, the FDA issued Import Alert 99-40 in response to a law passed by Congress, which states that the FDA may not allow the introduction or delivery for introduction into interstate commerce any food that contains GE salmon, until final labeling guidelines for informing consumers of such content are published. In December 2017, the FDA approved a supplementary NADA for an additional grow out facility for AAS located in Albany, Indiana. However, the FDA considers salmon eggs to meet the definition of food and its import alert to mean that AquaBounty cannot import AAS, including its eggs or any food from the salmon, into the United States.

Global regulations continue to evolve for gene-edited animal technologies where precise genetic additions or deletions are introduced into an animal's genome. On January 10, 2017, the FDA released a draft Revised Guidance for Industry which, when finalized, will represent the FDA's current thinking on the regulation of intentionally altered genomic DNA in animals. Although the USDA recently issued a statement indicating that in large part it would not regulate gene-edited plants as GMO crops, the FDA's guidance reiterates the FDA's historic position that it maintains oversight of gene-edited animals as "animal drugs". However, there is a growing global trend to significantly reduce the regulatory burden for gene-edited animals in other countries, such as Argentina and Brazil. For example, Argentina's National Advisory Commission on Agricultural Biotechnology has implemented a regulatory process where technology providers are able to submit data to demonstrate that no new genetic material is introduced into the

animal's genome. If the submission is successful, the product will not be subject to regulations governing genetically modified products in Argentina. Brazil has recently instituted a similar process. While such a process may significantly expedite time to market and may reduce developmental costs, we recognize the importance of also working with key stakeholders and the public to create product awareness and build public acceptance prior to commercialization.

Regulation of self-limiting insect technologies

Oxitec has developed a GE self-limiting line of the mosquito Aedes aegypti, OX513A, as well as a new second generation mosquito, OX5034. Moreover, Oxitec has developed other self-limiting insects to suppress crop pests. While the GE mosquito

Table of Contents

was historically subject to regulatory review by the FDA as a new animal drug, jurisdiction was shifted to the EPA in October 2017. Under the Federal Insecticide, Fungicide, and Rodenticide Act, or FIFRA, the EPA is charged with protecting human health and the environment by ensuring that registered pesticides do not cause unreasonable adverse effects to man or the environment. FIFRA's definition of "pesticide" includes "any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest". Prior to this shift, the FDA published in August 2016 a final EA and FONSI regarding impacts on human health, animal health and the environment of the OX513A GE mosquito based on review of information and evidence related to an investigational trial in Key Haven, Florida. Following the transfer of jurisdiction to the EPA, Oxitec submitted regulatory dossiers to the EPA for the release of the OX513A GE mosquito in Florida and other states. Oxitec is now seeking approval for trial releases of its OX5034 mosquito. Oxitec's OX513A and OX5034 GE mosquitos have also been approved by Brazil's National Biosafety Committee, or CTNBio, for community-wide releases. Additionally, open field trials of Oxitec's mosquitoes have been conducted in the Cayman Islands, Panama, and Malaysia under relevant permits or approvals. Further approvals will be required for commercial production and use.

Self-limiting GE insects used to control crop pests—instead of disease carrying vectors—are regulated by the USDA. Under the Plant Protection Act, the USDA's Animal and Plant Health Inspection Service, or APHIS, has broad authority to regulate plant pests to protect crops and other plants. Therefore, USDA regulates organisms and products that are known or suspected to be plant pests or that pose a plant pest risk, including those that have been genetically modified. While Oxitec's GE self-limiting insects are designed to suppress hard-to-control or resistant plant pests, they are still currently subject to the USDA's jurisdiction. When an applicant has developed sufficient data to demonstrate that the organism no longer poses a plant pest risk, the applicant can petition APHIS to "deregulate" the article, meaning the GE organism should no longer be considered a regulated article under APHIS regulations. In 2017, APHIS released a final EA and subsequent FONSI supporting a limited environmental release of Oxitec's GE diamondback moth. This conclusion was based on the finding that it would be unlikely for these insects to impact the physical, biological and human health environment. These self-limiting insects will also likely be subject to foreign agriculture GE regulations and authorizing bodies, such as CTNBio and the Ministry of Agriculture in Brazil as well as CONABIA in Argentina and the Office of the Gene Technology Regulator in Australia.

Regulation of agricultural technologies/plants and food products

The manufacturing, marketing and certain areas of research related to some of the potential food products developed by us and our subsidiaries and collaborators are subject to regulation by federal and state governmental authorities in the United States. As it relates to GE foods and/or plants, they are subject to regulation by the FDA, USDA, and EPA under the Coordinated Framework for the Regulation of Biotechnology. These technologies have been regulated under this framework for over two decades. Similar regulatory approval systems are in place globally as biotech crops have been planted in over 26 countries, including over 19 developing countries. Currently, our Arctic apple and Florian technologies are subject to these plant biotechnology regulations. As previously noted above for gene-edited animal technologies, global processes are evolving that we believe may streamline the review and assessment of these technologies. In a number of countries, including the United States, which has implemented an "Am I Regulated" process, specific gene-edited plant products will not be subject to GMO regulation if simple nucleotide changes were made and/or no new genetic material has been incorporated in the final product.

The Arctic apple, which is one of our commercial plant biotechnology products, has undergone significant regulatory review in recent years, and a few varieties have been successfully deregulated and authorized for sale in the United States. In February 2015, the USDA announced its decision to deregulate Okanagan's Golden Delicious apple variety and Granny Smith apple variety, or together the Arctic apples. In reaching its decision, the USDA conducted a final plant pest risk assessment concluding that Arctic apples are unlikely to pose a plant pest risk to agriculture and other plants in the United States. The USDA also completed an EA to comply with the NEPA and concluded that deregulation is not likely to have a significant impact on the human environment. Concurrent with the USDA, Okanagan also engaged in a voluntary food safety assessment consultation with the FDA regarding its Arctic apples. The FDA completed its assessment in March 2015. As part of bringing the assessment to closure, Okanagan was required to submit summaries of its safety and nutritional assessments for its Arctic apples. Based on the information provided by Okanagan and other information available to the agency, the FDA concluded the Arctic apple is not

materially different in safety, nutrition, composition, or other relevant characteristics from food and feed from apples currently on the market, and the apples do not raise any issues that would require premarket review or approval by the FDA. In August 2016, the USDA announced its decision to extend a preliminary determination of nonregulated status to Okanagan's Arctic Fuji apple variety.

Comparable authorities to the federal and state governmental authorities in the United States are involved in the regulation of plant technology products in other countries, such as the European Food Safety Authority in Europe, CONABIA in Argentina, CNTBio in Brazil, and Health Canada in Canada. For example, in relation to Okanagan, Health Canada announced its decision in March 2015 that it has no objection to the food use of the Arctic apple in Canada. In reaching its decision, Health Canada conducted a comprehensive assessment of the Golden Delicious and Granny Smith varieties according to its Guidelines for the

Table of Contents

Safety Assessment of Novel Foods. These guidelines are consistent with internationally accepted principles for establishing the safety of foods with novel traits adopted by the Codex Alimentarius Commission. Following this assessment, it was determined that the changes made to the Arctic apple did not pose a greater risk to human health than apples currently available on the Canadian market. In addition, Health Canada also concluded that the Arctic apple would have no impact on allergies and that there are no differences in the nutritional value of the Arctic apple compared to other traditional apple varieties available for consumption.

Regulation of microbes and microbial products

The use of GMMs, such as our yeast and methanotroph strains, is subject to laws and regulations in many countries. In the United States, the EPA regulates the commercial use of many GMMs as well as potential products produced from GMMs. Various states within the United States could choose to regulate products made with GMMs as well. While the strain of genetically-modified yeast that we use, S. cerevisiae, is eligible for exemption from EPA review because it is generally recognized as safe, we must satisfy certain criteria to achieve this exemption, including, but not limited to, use of compliant containment structures and safety procedures. We expect to encounter GMM regulations in most if not all of the countries in that we may seek to make our products; however, the scope and nature of these regulations will likely vary from country to country. If we cannot meet the applicable requirements in countries in which we intend to produce our products using GMMs, then our business will be adversely affected.

In addition to the use of the dried fermentation, biomass from the GMMs for animal feed is subject to approval as a new feed ingredient. In the United States, ingredients intended as components of animal feed must be either (i) described by an Association of American Feed Control Officials, or AAFCO, ingredient definition; (ii) generally recognized as safe, or GRAS, for the intended use; or (iii) approved food additives and listed in the Code of Federal Regulations, or CFR. The Federal Food, Drug and Cosmetic Act requires that any substance that is added to or is expected to become a component of animal food, either directly or indirectly, must be used in accordance with a food additive regulation unless it is GRAS for that intended use. The AAFCO Official Publication includes the list of approved food additives as well as the list of GRAS substances. In addition, many of the ingredients in the AAFCO Official Publication are not approved food additives and may not meet the criteria needed to be recognized as GRAS (21 CFR 570.30). Nevertheless, the FDA has accepted the listing of certain ingredients (e.g., those used as sources of nutrients, aroma, or taste) in the AAFCO Official Publication for their marketing in interstate commerce, provided there were no apparent safety concerns about the use or composition of the ingredient.

Regardless of the regulatory pathway, the following areas should be addressed: human food safety, target animal safety, environmental impact, utility (intended physical, nutritional or other technical effect), manufacturing chemistry, labeling, and proposed regulation. Based on preliminary evaluation, the feed derivative M. capsulatus biomass could potentially be commercialized following completion of the FDA's GRAS notification process. Under this process, the safety of M. capsulatus biomass is determined by a panel of experts, qualified by training and experience, to evaluate the feed ingredient, with a subsequent review and determination made by the FDA. If approved, the FDA then issues a "no objections" letter. However, if the 'killed' GM M. capsulatus is contained in the final feed product, additional data and information may be required to characterize the microbial ingredient, such as molecular characterization and potential pathogenicity. For use in Canada, the manufacture, sale and import of livestock feeds are regulated under the Feeds Act and Regulations administered by the CFIA. Under these regulations, all feeds must be safe to livestock, humans and the environment as determined by a premarket review.

Energy and chemical regulation

The environmental regulations discussed above also govern the development, manufacture and marketing of energy and chemical products. Chemical products produced by us and our collaborators may be subject to government regulations in our target markets. In the United States, the EPA administers the requirements of the TSCA, which regulates the commercial registration, distribution and use of many chemicals. Before an entity can manufacture or distribute significant volumes of a chemical, it needs to determine whether that chemical is listed in the TSCA inventory. If the substance is listed, then manufacture or distribution can commence immediately. If not, then in most cases a "Chemical Abstracts Service" number registration and pre-manufacture notice must be filed with the EPA, which has 90 days to review the filing. A similar requirement exists in Europe under the REACH regulation. Additional regulations may apply to specific subsets of chemicals such as, for example, fuel products that are subject

to regulation by various government agencies including, in the United States, the EPA and the California Air Resources Board.

Research and development

As of December 31, 2018, we had 464 research and development employees. We incurred expenses of $404.6 million, $143.2 million and $112.1 million in 2018, 2017, and 2016, respectively, on research and development activities. We anticipate that

Table of Contents

our research and development expenditures could increase as we investigate other applications for our synthetic biotechnologies and further develop our internally developed programs, including those we reacquired from former collaborators in 2018. Our primary domestic research and development operations are located in laboratory facilities in Germantown, Maryland; South San Francisco, California; Davis, California; and San Diego, California; and our primary international research and development operations are located in laboratory facilities in Budapest, Hungary; Ghent, Belgium; Campinas, Brazil; and Oxford, England.

Financial information

Collaboration revenues, product revenues, service revenues and other revenues and operating income for each of the last three fiscal years, along with assets as of December 31, 2018 and 2017, are set forth in the consolidated financial statements, which are included in Item 8 of this Annual Report. Financial information about geographic areas is set forth in "Notes to the Consolidated Financial Statements - Note 2" appearing elsewhere in this Annual Report.

Production

As of December 31, 2018, we had 232 production employees. Our primary domestic production facilities, including approximately 360 acres of land, are located in Sioux Center, Iowa. The land and facilities are primarily used for our embryo transfer and in vitro fertilization processes, as well as housing livestock used in such processes. We also lease or own regional production facilities and land in California, Maryland, Missouri, New York, Oklahoma, South Dakota, Texas, and Washington for these purposes. Additionally, we are scaling up commercial production of our non-browning apples in Washington and our AAS salmon in Canada, in anticipation of generating future revenues from each of these product lines.

Employees

As of December 31, 2018, we had 882 full-time and 97 part-time employees. We consider our employee relations to be good.

Corporate information

We are a Virginia corporation formed in 1998 and our principal executive offices are located at 20374 Seneca Meadows Parkway, Germantown, MD 20876, and our telephone number is (301) 556-9900.

Additional information

Our website is www.dna.com. The information on, or that can be accessed through, our website does not constitute part of, and is not deemed to be incorporated by reference into, this Annual Report. We post regulatory filings on this website as soon as reasonably practicable after they are electronically filed with or furnished to the SEC. These filings include annual reports on Form 10-K; quarterly reports on Form 10-Q; current reports on Form 8-K; Section 16 reports on Forms 3, 4, and 5; and any amendments to those reports filed with or furnished to the SEC. We also post our press releases on our website. Access to these filings or any of our press releases on our website is available free of charge. Copies are also available, without charge, from Intrexon Corporation Investor Relations, 20374 Seneca Meadows Parkway, Germantown, Maryland 20876. Reports filed with the SEC may be viewed at www.sec.gov.

In addition, our Corporate Governance Guidelines, Code of Business Conduct and Ethics, and charters for the Audit Committee, the Compensation Committee and the Nominating and Governance Committee are available free of charge to shareholders and the public through the "Corporate Governance" section of our website. Printed copies of the foregoing are available to any shareholder upon written request to our Communications Department at the address set forth on the cover of this Annual Report or may be requested through our website, www.dna.com.

Item 1A. Risk Factors

Investing in our common stock involves a high degree of risk. You should carefully consider the risks described below, together with the other information contained in this Annual Report, including our consolidated financial statements and the related notes appearing at the end of this Annual Report, before making your decision to invest in shares of our common stock. We cannot assure you that any of the events discussed in the risk factors below will not occur. These risks could have a material and adverse impact on our business, results of operations, financial condition or prospects. If that were to happen, the trading price of our common stock could decline, and you could lose all or part of your investment.

Table of Contents

This Annual Report also contains forward-looking statements that involve risks and uncertainties. Our actual results could differ materially from those anticipated in these forward-looking statements as a result of certain factors, including the risks faced by us described below and elsewhere in this Annual Report. See "Special Note Regarding Forward-Looking Statements" for information relating to these forward-looking statements.

RISKS RELATED TO OUR FINANCIAL POSITION, INDEBTEDNESS, OPERATING RESULTS AND NEED FOR ADDITIONAL CAPITAL

We have a history of net losses, and we may not achieve or maintain profitability.

We have incurred net losses since our inception, including net losses attributable to Intrexon of $509.3 million, $117.0 million and $186.6 million in 2018, 2017 and 2016, respectively. As of December 31, 2018, we had an accumulated deficit of $1.3 billion. We may incur losses and negative cash flow from operating activities for the foreseeable future. To date, we have derived a significant portion of our revenues from ECCs and license agreements, but we expect these revenues will decrease considerably as a result of our evolving business model. We no longer expect to receive reimbursement of costs incurred by us for research and development services and will no longer recognize previously deferred revenues associated with the terminated collaborations. In addition, after our reacquisition of rights to fields previously licensed to collaborators, we no longer expect to receive from those collaborators reimbursement of costs incurred by us for research and development services. If our existing collaborators terminate their ECCs, license agreements or JVs with us or we are unable to commercialize products through our subsidiaries and JVs or enter into strategic transactions, our revenues could be adversely affected. In addition, certain of our collaborations and license agreements provide for milestone payments, future royalties and other forms of contingent consideration, the payment of which are uncertain as they are dependent on our collaborators' abilities and willingness to successfully develop and commercialize products. Moreover, many of the products being commercialized by us are in the early stages of development or preliminary stages of sales. We expect a significant period of time could pass before the achievement of contractual milestones and the realization of royalties on products commercialized under our collaborations or before commercialization of our various products and revenues is sufficient to achieve profitability. As a result, our expenses may exceed revenues for the foreseeable future, and we may not achieve profitability. If we fail to achieve profitability, or if the time required to achieve profitability is longer than we anticipate, we may not be able to continue our business. Even if we do achieve profitability, we may not be able to sustain or increase profitability on a quarterly or annual basis.

We will need substantial additional capital in the future in order to fund our business and have identified conditions that raise substantial doubt about our ability to continue as a going concern.

Our consolidated financial statements as of and for the year ended December 31, 2018 have been prepared on the basis that we will continue as a going concern, which contemplates the realization of assets and satisfaction of liabilities in the normal course of business. We have incurred significant losses since our inception and we expect that we will continue to incur losses as we aim to successfully execute our business plan. We are and will continue to be dependent on additional public or private financings, new collaborations or licensing arrangements with strategic partners, or additional equity and debt financing sources to fund continuing operations. Based on our balance of cash, cash equivalents and short-term investments of $222.5 million at December 31, 2018 and recurring losses since inception, there is substantial doubt about our ability to continue as a going concern within one year after the date that these financial statements are issued. We expect our future capital requirements will be substantial, particularly as we continue to develop our business and pursue our internal research and development programs and for capital investment needed to scale up our commercial operations. Our need for additional capital will depend on many factors, including:

- progress in our research and development programs, as well as the magnitude of these programs;
- the timing, receipt, and amount of any payments received in connection with strategic transactions;
- the timing, receipt, and amount of upfront, milestone, and other payments, if any, from present and future collaborators, if any;
- the timing, receipt, and amount of sales and royalties, if any, from our potential products;
- our ability to maintain or improve the volume and pricing of our current product and service offerings and to develop new offerings, including those that may incorporate new technologies;

- costs we might incur to reacquire previously licensed rights for our own development;

Table of Contents

- the timing and capital requirements to scale up our various product and service offerings and customer acceptance thereof;
- our ability to maintain and establish additional collaborative arrangements and/or new strategic initiatives;
- the timing of regulatory approval of products of our collaborations and operations;
- the resources, time, and cost required for the preparation, filing, prosecution, maintenance, and enforcement of patent claims;
- investments we may make in current and future collaborators, including JVs;
- strategic mergers and acquisitions, including both the upfront acquisition cost as well as the cost to integrate, maintain, and expand the strategic target; and
- the costs associated with legal activities, including litigation, arising in the course of our business activities and our ability to prevail in any such legal disputes.

If future financings involve the issuance of equity securities, our existing shareholders would suffer further dilution. If we raise additional debt financing, we may be subject to restrictive covenants that limit our ability to conduct our business. We may not be able to raise sufficient additional funds on terms that are favorable to us, if at all. If we fail to raise sufficient funds and continue to incur losses, our ability to fund our operations, take advantage of strategic opportunities, develop products or technologies, or otherwise respond to competitive pressures could be significantly limited. If this happens, we may be forced to delay or terminate research or development programs or the commercialization of products resulting from our technologies, curtail or cease operations or obtain funds through strategic transactions, ECCs, JVs or other collaborative and licensing arrangements that may require us to relinquish commercial rights, or grant licenses on terms that are not favorable to us. If adequate funds are not available, we will not be able to successfully execute our business plan or continue our business.

Servicing our debt requires a significant amount of cash, and we may not have sufficient cash flows from our business to pay our substantial debt.

Our ability to make scheduled payments of the principal of, to pay interest on or to refinance our indebtedness, including the 3.50 percent convertible senior notes due 2023, or Convertible Notes, issued in July 2018, depends on our future performance, which is subject to economic, financial, competitive and other factors beyond our control. Our business may not continue to generate cash flows from operations in the future sufficient to service our debt and make necessary capital expenditures. If we are unable to generate such cash flows, we may be required to adopt one or more alternatives, such as selling assets, restructuring debt or obtaining additional equity capital on terms that may be onerous or highly dilutive. Our ability to refinance our 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.

The Convertible Notes are our exclusive obligations and are not guaranteed by any of our operating subsidiaries. A substantial portion of our consolidated assets is held by our subsidiaries. Accordingly, our ability to service our debt, including the Convertible Notes, depends on the results of operations of our subsidiaries and upon the ability of such subsidiaries to provide us with cash, whether in the form of dividends, loans or otherwise, to pay amounts due on our obligations, including the Convertible Notes. Our subsidiaries are separate and distinct legal entities and have no obligation, contingent or otherwise, to make payments on the Convertible Notes or to make any funds available for that purpose. In addition, dividends, loans or other distributions to us from such subsidiaries may be subject to contractual and other restrictions and are subject to other business considerations.

Despite our current debt levels, we may still incur substantially more debt or take other actions that would intensify the risks discussed above.

Despite our current consolidated debt levels, we and our subsidiaries may incur substantial additional debt in the future, subject to the restrictions contained in our debt instruments, some of which may be secured debt. We are not restricted under the terms of the indenture governing the Convertible Notes from incurring additional debt, securing existing or future debt, recapitalizing our debt or taking a number of other actions that are not limited by the terms of the indenture governing the Convertible Notes that could have the effect of diminishing our ability to make payments on the Convertible Notes when due.

26

Table of Contents

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

Holders of Convertible Notes have the right to require us to repurchase their Convertible Notes upon the occurrence of a fundamental change at a fundamental change repurchase price equal to 100 percent of the principal amount of the Convertible Notes to be repurchased, plus accrued and unpaid interest, if any. In addition, upon conversion of the Convertible 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 Convertible Notes being converted. However, we may not have enough available cash or be able to obtain financing at the time we are required to make repurchases of Convertible Notes surrendered therefor or Convertible Notes being converted. In addition, our ability to repurchase the Convertible Notes or to pay cash upon conversions of the Convertible Notes may be limited by law, by regulatory authority or by agreements governing our future indebtedness. Our failure to repurchase Convertible Notes at a time when the repurchase is required by the indenture or to pay any cash payable on future conversions of the Convertible Notes as required by the indenture would constitute a default under the indenture. A default under the indenture 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 Convertible Notes or make cash payments upon conversions thereof.

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

In the event the conditional conversion feature of the Convertible Notes is triggered, holders of Convertible Notes will be entitled to convert the Convertible Notes at any time during specified periods at their option. If one or more holders elect to convert their Convertible 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 Convertible Notes, we could be required under applicable accounting rules to reclassify all or a portion of the outstanding principal of the Convertible Notes as a current rather than long-term liability, which would result in a material reduction of our net working capital.

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

In May 2008, the Financial Accounting Standards Board, or FASB, issued FASB Staff Position No. APB 14-1, Accounting for Convertible Debt Instruments That May Be Settled in Cash Upon Conversion (Including Partial Cash Settlement), which has subsequently been codified as Accounting Standards Codification, or ASC, Subtopic 470-20, Debt with Conversion and Other Options, or ASC 470-20. Under ASC 470-20, an entity must separately account for the liability and equity components of the convertible debt instruments (such as the Convertible Notes) that may be settled entirely or partially in cash upon conversion in a manner that reflects the issuer's economic interest cost. The effect of ASC 470-20 on the accounting for the Convertible Notes is that the equity component is required to be included in the additional paid-in capital section of shareholders' equity on our consolidated balance sheet, and the value of the equity component would be treated as original issue discount for purposes of accounting for the debt component of the Convertible Notes. As a result, we record a greater amount of noncash interest expense in current periods presented as a result of the amortization of the discounted carrying value of the Convertible Notes to their face amount over the term of the Convertible Notes. We report lower net income in our financial results because ASC 470-20 requires interest to include both the current period's amortization of the debt discount and the instrument's coupon interest, which could adversely affect our reported or future financial results, the trading price of our common stock and the trading price of the Convertible Notes.

In addition, under certain circumstances, convertible debt instruments (such as the Convertible Notes) that may be settled entirely or partly in cash are currently accounted for utilizing the treasury stock method, the effect of which is that the shares issuable upon conversion of the Convertible Notes are not included in the calculation of diluted earnings per share except to the extent that the conversion value of the Convertible Notes exceeds their principal

amount. Under the treasury stock method, for diluted earnings per share purposes, the transaction is accounted for as if the number of shares of common stock that would be necessary to settle such excess, if we elected to settle such excess in shares, are issued. We cannot be sure that the accounting standards in the future will continue to permit the use of the treasury stock method. If we are unable to use the treasury stock method in accounting for the shares issuable upon conversion of the Convertible Notes, then our diluted earnings per share would be adversely affected.

Table of Contents

Our quarterly and annual operating results may fluctuate in the future. As a result, we may fail to meet or exceed the expectations of research analysts or investors, which could cause our stock price to decline.

Our financial condition and operating results have varied significantly in the past and may continue to fluctuate from quarter to quarter and year to year in the future due to a variety of factors, many of which are beyond our control. Factors relating to our business that may contribute to these fluctuations include the following factors, as well as other factors described elsewhere in this Annual Report:

- our ability to achieve or maintain profitability;
- the feasibility of producing and commercializing products enabled by our technologies;
- our ability to enter into strategic transactions, collaborations, or JVs;
- our relationships, and the associated exclusivity terms, with collaborators and licensees in our target end markets;
- our ability to develop and maintain technologies that our collaborators and licensees continue to use and that new collaborators are seeking;
- obligations to provide resources to our collaborators or to the collaborations themselves pursuant to the terms of the relevant ECC, license agreement or JV agreement;
- our ability to manage our growth;
- the outcomes of research programs, clinical trials, or other product development and approval processes conducted by us and our collaborators and licensees;
- the ability of us and our collaborators and licensees to develop and successfully commercialize products enabled by our technologies;
- our ability to successfully scale up production of our commercial products and customer acceptance thereof;
- risks associated with the international aspects of our business;
- our ability to integrate any businesses or technologies we may acquire with our business;
- our ability to accurately report our financial results in a timely manner;
- our dependence on, and the need to attract and retain, key management and other personnel;
- our ability to obtain, protect and enforce our intellectual property rights;
- our ability to prevent the theft or misappropriation of our intellectual property, know-how or technologies;
- potential advantages that our competitors, the competitors of our collaborators, and potential competitors may have in securing funding or developing competing technologies or products;
- our ability to obtain additional capital that may be necessary to expand our business;
- our collaborators' ability to obtain additional capital that may be necessary to develop and commercialize products under our ECCs, license agreements and JVs;
- business interruptions such as power outages and other natural disasters;
- public concerns about the ethical, legal and social ramifications of GE products and processes;
- the impact of new accounting pronouncements on our current and future operating results;
- our ability to use our net operating loss carryforwards to offset future taxable income; and

Table of Contents

- the results of our consolidated subsidiaries.

Due to the various factors mentioned above, and others, the results of any prior quarterly or annual periods should not be relied upon as indications of our future operating performance.

We have a limited operating history, which may make it difficult to evaluate our current business and predict our future performance.

Our limited operating history and the evolution of our business model may make it difficult to evaluate our current business and predict our future performance. Any assessments of our current business and predictions made about our future success or viability may not be as accurate as they could be if we had a longer operating history. We have encountered and will continue to encounter risks and difficulties frequently experienced by growing companies in rapidly changing industries. If we do not address these risks successfully, our business will be harmed.

We may pursue strategic acquisitions and investments that could have an adverse impact on our business if they are unsuccessful.

We have made acquisitions in the past and, if appropriate opportunities become available, we may acquire additional businesses, assets, technologies or products to enhance our business in the future. In connection with any future acquisitions, we could:

- issue additional equity securities, which would dilute our current shareholders;
- incur substantial debt to fund the acquisitions; or
- assume significant liabilities.

Although we conduct due diligence reviews of our acquisition targets, such processes may fail to reveal significant liabilities. Acquisitions involve numerous risks, including:

- problems integrating the purchased operations, facilities, technologies or products;
- unanticipated costs and other liabilities;
- diversion of management's attention from our core businesses;
- adverse effects on existing business relationships with current and/or prospective collaborators, customers and/or suppliers;
- risks associated with entering markets in which we have no or limited prior experience; and
- potential loss of key employees.

Acquisitions also may require us to record goodwill and non-amortizable intangible assets that will be subject to impairment testing on a regular basis and potential periodic impairment charges, incur amortization expenses related to certain intangible assets, and incur large and immediate write-offs and restructuring and other related expenses, all of which could harm our operating results and financial condition. In addition, we may acquire companies that have insufficient internal financial controls, which could impair our ability to integrate the acquired company and adversely impact our financial reporting. If we fail in our integration efforts with respect to any of our acquisitions and are unable to efficiently operate as a combined organization, our business and financial condition may be adversely affected.

We recorded a $60.5 million impairment charge in the year ended December 31, 2018. See "Notes to the Consolidated Financial Statements - Note 11" appearing elsewhere in this Annual Report for additional discussion.

We may encounter difficulties in connection with our acquisitions.

We cannot be certain that any acquisition will be successful or that we will realize the anticipated benefits of the acquisition. In particular, we may not be able to realize the strategic and operational benefits and objectives we had anticipated. In addition,

Table of Contents

we may face increased competition in the markets for any acquired products. Any of the following factors may have a material adverse effect on our business, operating results and financial condition. These factors may include:

- the potential disruption of our ongoing business and diversion of management resources;
- unanticipated expenses related to the acquired operations;
- the impairment of relationships with the acquired customers;
- the impairment of relationships with key suppliers and their ability to meet our demand;
- potential unknown liabilities associated with the acquired business and technology;
- potential liabilities related to litigation involving the acquired companies;
- potential periodic impairment of goodwill and intangible assets acquired; and
- potential inability to retain, integrate and motivate key personnel.

We own equity interests in several of our collaborators and have exposure to the volatility and liquidity risks inherent in holding their equity.

We own equity interests in several of our collaborators. The process by which we obtain equity interests in our collaborators and the factors we consider in deciding whether to acquire, hold or dispose of these equity positions may differ significantly from those that an independent investor would consider when purchasing equity interests in the collaborator. One significant factor would include our own expectation as to the success of our efforts to assist the collaborator in developing products enabled by our technologies. Owning equity in our collaborators increases our exposure to the risks of our collaborators' businesses beyond the products of those collaborations. Our equity ownership in our collaborators exposes us to volatility and the potential for negative returns. We may have restrictions on resale and/or limited markets to sell our equity ownership. In many cases, our equity position is a minority position which exposes us to further risk as we are not able to exert control over the companies in which we hold securities.

In connection with future collaborations or JVs, we may, from time to time, receive from collaborators, both public and private, warrants, rights and/or options, all of which involve special risks. To the extent we receive warrants or options in connection with future collaborations or JVs, we would be exposed to risks involving pricing differences between the market value of underlying securities and our exercise price for the warrants or options, a possible lack of liquidity and the related inability to close a warrant or options position, all of which could ultimately have an adverse effect on our financial position.

We use estimates in determining the fair value of certain assets and liabilities. If our estimates prove to be incorrect, we may be required to write down the value of these assets or write up the value of these liabilities, which could adversely affect our financial position.

Our ability to measure and report our financial position and operating results is influenced by the need to estimate the impact or outcome of future events on the basis of information available at the time of the financial statements. An accounting estimate is considered critical if it requires that management make assumptions about matters that were highly uncertain at the time the accounting estimate was made. If actual results differ from management's judgments and assumptions, then they may have an adverse impact on our results of operations and cash flows.

Fair value is estimated based on a hierarchy that maximizes the use of observable inputs and minimizes the use of unobservable inputs. Observable inputs are inputs that reflect the assumptions that market participants would use in pricing the asset or liability developed based on market data obtained from sources independent of the reporting entity. Unobservable inputs are inputs that reflect the reporting entity's own assumptions about the assumptions market participants would use in pricing the asset or liability developed based on the best information available in the circumstances. The fair value hierarchy prioritizes the inputs to valuation techniques into three broad levels whereby the highest priority is given to Level 1 inputs and the lowest to Level 3 inputs.

Valuations are highly dependent upon the reasonableness of management's assumptions and the predictability of the relationships that drive the results of our valuation methodologies. Because of the inherent unpredictability in the future

Table of Contents

performance of the investments requiring Level 3 valuations, we may be required to adjust the value of certain assets, which could adversely affect our financial position.

We rely on our subsidiaries, collaborators and other third parties to deliver timely and accurate information in order to accurately report our financial results in the time frame and manner required by law.

We need to receive timely, accurate and complete information from a number of third parties in order to accurately report our financial results on a timely basis. We rely on our subsidiaries and collaborators to provide us with complete and accurate information regarding revenues, expenses and payments owed to or by us on a timely basis. In addition, we intend to rely on current and future collaborators under our collaboration agreements and JVs to provide us with product sales and cost saving information in connection with royalties, if any, owed to us. If the information that we receive is not accurate, our consolidated financial statements may be materially incorrect and may require restatement, and we may not receive the full amount of consideration to which we are entitled under our collaboration agreements or JVs. Although we have audit rights with these parties, performing such an audit could be expensive and time consuming and may not be adequate to reveal any discrepancies in a time frame consistent with our reporting requirements. We own a significant equity position in several of our collaborators, including a majority position in one of our collaborators. In the future, we may need to consolidate the financial statements of one or more other collaborators into our consolidated financial statements. Although we have contractual rights to receive information and certifications allowing us to do this, such provisions may not ensure that we receive information that is accurate or timely. As a result, we may have difficulty completing accurate and timely financial disclosures, which could have an adverse effect on our business.

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

As of December 31, 2018, we had net operating loss carryforwards of approximately $369.1 million for United States federal income tax purposes available to offset future taxable income, including $116.6 million generated after 2017, and United States federal and state research and development tax credits of $7.9 million prior to consideration of annual limitations that may be imposed under Section 382 of the Internal Revenue Code of 1986, as amended, or Section 382. Carryforwards generated prior to 2018 begin to expire in 2022. As a result of our past issuances of stock, as well as due to prior mergers and acquisitions, certain of Intrexon's net operating losses have been subject to limitations pursuant to Section 382. As of December 31, 2018, Intrexon has utilized all net operating losses subject to Section 382 limitations, other than those losses inherited via acquisitions. As of December 31, 2018, approximately $41.9 million of domestic net operating losses were acquired via acquisition and are limited based on the value of the target at the time of the transaction. Future changes in stock ownership may also trigger an ownership change and, consequently, a Section 382 limitation. As of December 31, 2018, our direct foreign subsidiaries had foreign loss carryforwards of approximately $159.8 million, most of which do not expire.

The Tax Cuts and Jobs Act of 2017, or Tax Act, introduced certain limitations on utilization of losses that are generated after 2017, generally limiting utilization of those losses to 80 percent of future annual taxable income. However, losses generated after 2017 will generally have an indefinite carryforward period.

We are exposed to exchange rate fluctuation.

We have international subsidiaries in a number of foreign countries, including Belgium, Brazil, Canada, Hungary, and the United Kingdom. As a consequence, we are exposed to risks associated with changes in foreign currency exchange rates. We present our consolidated financial statements in United States dollars. Our international subsidiaries have assets and liabilities denominated in currencies other than the United States dollar. Future expenses and revenues of our international subsidiaries are expected to be denominated in currencies other than in United States dollars. Therefore, movements in exchange rates to translate from foreign currencies may have an impact on our reported results of operations, financial position and cash flows.

RISKS RELATED TO OUR TECHNOLOGIES AND BUSINESS OPERATIONS

Ethical, legal and social concerns about synthetic biologically engineered products and processes could limit or prevent the use of products or processes using our technologies, limit consumer acceptance and limit our revenues.

Our technologies and the technologies of our JVs and collaborators involve the use of synthetic biologically engineered products or synthetic biological technologies. Public perception about the safety and environmental hazards of, and ethical concerns over, GE products and processes could influence public acceptance of our and our

collaborators' technologies, products and processes.

Table of Contents

The subject of GMOs has received negative publicity, which has aroused public debate. In addition, certain of the products of our operating subsidiaries have been the subject of negative publicity, including AAS, Arctic apples and GE mosquitoes. This adverse publicity has led to, and could continue to lead to, greater regulation and trade restrictions on imports of genetically altered products. Further, there is a risk that products produced using our technologies could cause adverse health effects or other adverse events, which could also lead to negative publicity. There is also an active and vocal group of opponents to GMOs who wish to ban or restrict the technology and who, at a minimum, hope to sway consumer perceptions and acceptance of this technology. Their efforts include regulatory legal challenges and labeling campaigns for genetically modified products, as well as application of pressure to consumer retail outlets seeking a commitment not to carry genetically modified products. Further, these groups have a history of bringing legal action against companies attempting to bring new biotechnology products to market. For example, on March 30, 2016, a coalition of non-governmental organizations filed a complaint against the FDA, the United States Fish and Wildlife Service, and related individuals for their roles in the approval of AAS. We may be subject to future additional litigation brought by one or more of these organizations in their attempt to block the development or sale of our products. In addition, animal rights groups and various other organizations and individuals have attempted to stop genetic engineering activities by pressing for legislation and additional regulation in these areas. We may not be able to overcome the negative consumer perceptions and potential legal hurdles that these organizations seek to instill or assert against our products, and our business could be harmed.

If we and our collaborators are not able to overcome the ethical, legal and social concerns relating to synthetic biological engineering, products and processes using our technologies may not be accepted. These concerns could result in increased expenses, regulatory scrutiny, delays or other impediments to our programs or the public acceptance and commercialization of products and processes dependent on our technologies or inventions. The ability of us and our collaborators to develop and commercialize products, or processes using our technologies could be limited by public attitudes and governmental regulation.

Inadvertent releases or unintended consequences of releases of synthetic biology technologies by us or others could lead to adverse effects on our business and results of operations.

The synthetic biological technologies that we develop may have significantly enhanced characteristics compared to those found in naturally occurring organisms, enzymes or microbes. While we produce many of these synthetic biological technologies only for use in a controlled laboratory and industrial environment, the release of such synthetic biological technologies into uncontrolled environments could have unintended consequences. Any adverse effect resulting from such a release, by us or others, could have a material adverse effect on the public acceptance of our products and our business and financial condition. Such a release could result in enhanced regulatory activity and we could have exposure to liability for any resulting harm.

We may become subject to increasing regulation in the future.

We have a diverse portfolio of proprietary and complementary technologies in the areas of human health, animal health, public health and energy that are subject to significant and diverse regulations that govern research, operations and product approval. Regulatory compliance is critical to our freedom to operate, our management of potential liabilities and, ultimately, our freedom to sell our and our collaborators' products. While we and our subsidiaries maintain regulatory compliance practices, we rely on our collaborators' compliance with laws and regulations applicable to the products they produce. We do not independently monitor whether our collaborators comply with applicable laws and regulations. Failure to comply with applicable regulatory requirements may subject us to administrative and/or judicially imposed sanctions or monetary penalties as well as reputational and other harms. Moreover, obtaining and maintaining regulatory approval have been, and will likely continue to be, increasingly difficult, time consuming and costly. Legislative bodies or regulatory agencies could enact new laws or regulations, change existing laws or regulations, or change their interpretations of laws or regulations at any time, which could affect our ability to obtain or maintain approval of our products or product candidates. The rate and degree of change in existing laws and regulations and regulatory expectations have accelerated in established markets, and regulatory expectations continue to evolve in emerging markets. We are unable to predict whether and when such changes could occur or whether such changes will have a material adverse effect on our business.

We have limited experience bringing new products through development and successful commercialization. Even if our technologies enable new products, we or our collaborators may not be successful in commercializing the products that result from our technologies.

Even if our technologies enable new products, there is no guarantee that we or our collaborators will be successful in creating additional products enabled by our technologies. Furthermore, neither we nor our collaborators may be able to commercialize the resulting products or our collaborators may decide to use other methods competitive with our technologies that do not utilize synthetic biology. Several of our wholly and majority-owned subsidiaries have received regulatory approvals, including

Table of Contents

AquaBounty and Okanagan. These approvals do not, however, guarantee our success in commercializing the products of these subsidiaries. If we are not successful in commercializing our products, our business could be harmed.

Changing labeling requirements may negatively impact consumer acceptance of the products of our operating subsidiaries.

Historically, we were not required to label AAS or our Arctic apples at the retail level as containing genetically modified ingredients. However, because several states either passed or considered new laws specifying varying requirements for labeling such products, the United States Congress passed the National BioEngineered Food Disclosure Law in July 2016 to establish a national mandatory standard for labeling for foods that are or may be bioengineered. As part of the new law, Congress directed the USDA to establish the disclosure standards. On December 20, 2018, the USDA released its National Bioengineered Food Disclosure Standard that defined bioengineered foods as "those that contain detectable genetic material that has been modified through certain lab techniques and cannot be created through conventional breeding or found in nature." The Agricultural Marketing Service of the USDA also developed the List of Bioengineered Foods identifying certain bioengineered crops or foods and for which regulated entities must maintain records. Both AAS and our Arctic apples are part of this list and we are currently in the process of assessing the impact of the new regulations on us and our subsidiaries. However, the mandatory labeling requirements could cause consumers to view the label as either a warning or as an indication that AAS is inferior to traditional Atlantic salmon or our Arctic apples are inferior to traditional apples. These perceptions could negatively impact consumer acceptance of the products of our operating subsidiaries and ultimately harm our business.

The FDA has only approved a few gene therapies and regulation of gene therapies is still nascent.

The FDA first approved a gene therapy for use in humans in 2017, and to date has only approved a limited number. Regulatory requirements governing gene and cell therapy products have changed frequently and may continue to change in the future. The field of gene therapies is still very early in development and remains predominantly experimental. Clinical trials with gene therapies have encountered a multitude of significant technical problems in the past, including unintended integration with host DNA leading to serious adverse events, poor levels of protein expression, transient protein expression, viral overload, immune reactions to either viral capsids utilized to deliver DNA, DNA itself, proteins expressed or cells transfected with DNA. There can be no assurance that our development efforts or those of our collaborators will be timely or successful, that we or they will receive the regulatory approvals necessary to initiate clinical trials, where applicable, or that we will ever be able to successfully commercialize a product enabled by our technologies. To the extent that we or our collaborators utilize viral constructs or other systems to deliver gene therapies and the same or similar delivery systems demonstrate unanticipated and/or unacceptable side effects in preclinical or clinical trials conducted by ourselves or others, we may be forced to, or elect to, discontinue development of such products.

If we lose key personnel, including key management personnel, or are unable to attract and retain additional personnel, it could delay our product development programs, harm our research and development efforts, and we may be unable to pursue collaborations or develop our own products.

Our business involves complex operations across a variety of markets and requires a management team and employee workforce that is knowledgeable in the many areas in which we operate. The loss of any key members of our management, including our Chief Executive Officer, Randal J. Kirk, or the failure to attract or retain other key employees who possess the requisite expertise for the conduct of our business, could prevent us from developing and commercializing our products for our target markets and entering into collaborations or licensing arrangements to execute on our business strategy. In addition, the loss of any key scientific staff, or the failure to attract or retain other key scientific employees, could prevent us from developing our technologies for our target markets or from further developing and commercializing our products and services offerings to execute on our business strategy. We may not be able to attract or retain qualified employees in the future due to the intense competition for qualified personnel among biotechnology, synthetic biology and other technology-based businesses, or due to the unavailability of personnel with the qualifications or experience necessary for our business. If we are not able to attract and retain the necessary personnel to accomplish our business objectives, we may experience staffing constraints that will adversely affect our ability to meet the demands of our collaborators and customers in a timely fashion or to support our internal

research and development programs. In particular, our product and process development programs are dependent on our ability to attract and retain highly skilled scientists. Competition for experienced scientists and other technical personnel from numerous companies and academic and other research institutions may limit our ability to attract and retain such personnel on acceptable terms.

Our planned activities, including the further development and scale-up of operating subsidiaries, will require additional expertise in specific industries and areas applicable to the products and processes developed through our technologies or acquired through strategic or other transactions, especially in the end markets that we seek to penetrate. These activities will

Table of Contents

require the addition of new personnel, and the development of additional expertise by existing personnel. The inability to attract personnel with appropriate skills or to develop the necessary expertise could impair our ability to grow our business.

We have limited financial and managerial resources, requiring us to prioritize our development efforts over other opportunities.

Because we have limited financial and managerial resources, we will be required to prioritize our application of resources to particular development efforts. Any resources we expend on one or more of these efforts could be at the expense of other potentially profitable opportunities. If we focus our efforts and resources on one or more of these opportunities or markets and they do not lead to commercially viable products, our revenues, financial condition and results of operations could be adversely affected.

We may encounter difficulties managing our growth, which could adversely affect our business.

Currently, we are working simultaneously on multiple projects targeting several industries. These diversified operations place increased demands on our limited resources and require us to substantially expand the capabilities of our administrative and operational resources and to attract, train, manage and retain qualified management, technicians, scientists and other personnel. As our operations expand domestically and internationally, we will need to continue to manage multiple locations and additional relationships with various customers, collaborators, suppliers and other third parties. Our ability to manage our operations, growth and various projects effectively will require us to make additional investments in our infrastructure to continue to improve our operational, financial and management controls and our reporting systems and procedures and to attract and retain sufficient numbers of talented employees, which we may be unable to do effectively. As a result, we may be unable to manage our expenses in the future, which may negatively impact our gross margins or operating margins in any particular quarter. In addition, we may not be able to successfully improve our management information and control systems, including our internal control over financial reporting, to a level necessary to manage our growth.

Competitors and potential competitors may develop products and technologies that make ours obsolete or garner greater market share than ours.

We do not believe that we have any direct competitors who provide comparable technologies of similar depth and breadth that enable to the same extent the commercialization of products developed using synthetic biology across a broad spectrum of biologically-based industries. However, there are companies that have competing technologies for individual pieces of our proprietary suite of complementary technologies. One portion of our proprietary technology related to DNA synthesis and assembly includes the ability to synthesize new DNA. We believe the following companies engage in the manufacture of DNA components: ATUM, Inc.; Blue Heron Biotech, LLC (a subsidiary of OriGene); Integrated DNA Technologies, Inc. (IDT); GenScript USA, Inc.; Life Technologies Corporation, now part of Thermo Fisher Scientific Inc.; and Twist BioScience Corporation.

The synthetic biology industry and each of the commercial sectors we have targeted are characterized by rapid technological change and extensive competition. Our future success will depend on our ability to maintain a competitive position with respect to technological advances. Academic institutions also are working in this field. Technological development by others may result in our technologies, as well as products developed by our collaborators using our technologies, becoming obsolete.

The rapidly evolving market for developing GE T-cells in particular, is characterized by intense competition and rapid innovation. Genetically engineering T-cells faces significant competition in the CAR technology space from multiple companies and their collaborators, such as Novartis/University of Pennsylvania, Bluebird Bio/Celgene/Juno Therapeutics, Gilead/Kite Pharma, Cellectis, Allogene Therapeutics, Adaptimmune/GSK, Autolus Therapeutics, and Bellicum Pharmaceuticals. We face competition from non-cell based treatments offered by other companies such as Amgen, AstraZeneca, Bristol-Myers Squibb, Incyte, Merck, and Roche.

Our ability to compete successfully will depend on our ability to develop proprietary technologies that can be used by our collaborators to produce products that reach the market in a timely manner and are technologically superior to and/or are less expensive than other products on the market. Certain of our competitors may benefit from local government subsidies and other incentives that are not available to us or our collaborators. As a result, our competitors may be able to develop competing and/or superior technologies and processes, and compete more aggressively and

sustain that competition over a longer period of time than we or our collaborators can. As more companies develop new intellectual property in our markets, a competitor could acquire patent or other rights that may limit products using our technologies, which could lead to litigation.

Table of Contents

We may be sued for product liability.

Each of our collaborations requires the collaborator to indemnify us for liability related to products produced pursuant to the ECC or JV and to obtain insurance coverage related to product liability in amounts considered standard for the industry. We believe that these industry-standard coverage amounts range from $10 million to $40 million in the aggregate. Even so, we may be named in product liability suits relating to products that are produced by our collaborators using our technologies. Moreover, as we develop more products through our own operations and JVs, our potential exposure to such claims will increase. These claims could be brought by various parties, including other companies who purchase products from us or our collaborators or by the end users of the products. We cannot guarantee that our collaborators will not breach the indemnity and insurance coverage provisions of the ECCs or JVs. Further, insurance coverage is expensive and may be difficult to obtain, and may not be available to us or to our collaborators in the future on acceptable terms, or at all. We cannot assure you that we or our collaborators will have adequate insurance coverage against potential claims. In addition, although we currently maintain product liability insurance for our technologies in amounts we believe to be commercially reasonable, if the coverage limits of these insurance policies are not adequate, a claim brought against us, whether covered by insurance or not, could have a material adverse effect on our business, results of operations, financial condition and cash flows. This insurance may not provide adequate coverage against potential losses, and if claims or losses exceed our liability insurance coverage, we may go out of business. If we cannot successfully defend ourselves against product liability claims, we may incur substantial liabilities or be required to limit commercialization of our product candidates. Regardless of the merits or eventual outcome, liability claims may result in:

- reduced resources of our management to pursue our business strategy;
- decreased demand for products enabled by our technologies;
- injury to our or our collaborators' reputations and significant negative media attention;
- withdrawal of clinical trial participants;
- initiation of investigations by regulators;
- product recalls, withdrawals or labeling, marketing or promotional restrictions;
- significant costs to defend resulting litigation;
- substantial monetary awards to trial participants or patients;
- loss of revenue; and
- the inability to commercialize any products using our technologies.

We depend on sophisticated information technology and infrastructure.

We rely on various information systems to manage our operations. These systems are complex and include software that is internally developed, software licensed from third parties and hardware purchased from third parties. These products may contain internal errors or defects, particularly when first introduced or when new versions or enhancements are released. Failure of these systems could have an adverse effect on our business, which in turn may materially adversely affect our operating results and financial condition.

If we experience a significant breach of data security or disruption in our information systems, our business could be adversely affected.

We rely on various information systems to manage our operations and to store information, including sensitive data such as confidential business information and personally identifiable information. These systems could be vulnerable to interruption or malfunction, including due to events beyond our control, and to unauthorized access, computer hackers, ransomware, viruses and other security problems. Failure of these systems or any significant breach of our data security could have an adverse effect on our business and may materially adversely affect our operating results and financial condition.

Data security breaches could result in loss or misuse of information, which could, in turn, result in potential regulatory actions or litigation, including material claims for damages, compelled compliance with breach notification laws, interruption to our

Table of Contents

operations, damage to our reputation or could otherwise have a material adverse effect on our business, financial condition and operating results. Companies throughout our industry have been increasingly subject to a wide variety of security incidents, cyber-attacks and other attempts to gain unauthorized access to networks or sensitive information. While we have implemented and continue to implement cybersecurity safeguards and procedures, we may be unable to implement adequate protective measures. As cyber threats continue to evolve, we may be required to expend additional resources to enhance our cybersecurity measures or to investigate or remediate any vulnerabilities or breaches.

Although we maintain insurance to protect ourselves in the event of a breach or disruption of our information systems, we cannot ensure that the coverage is adequate to compensate for any damages that may be incurred.

We may incur significant costs complying with environmental, health and safety laws and regulations, and failure to comply with these laws and regulations could expose us to significant liabilities.

We use hazardous chemicals and radioactive and biological materials in our business and are subject to a variety of federal, state, local and international laws and regulations governing, among other matters, the use, generation, manufacture, transportation, storage, handling, disposal of, and human exposure to these materials both in the United States and overseas, including regulation by governmental regulatory agencies, such as the Occupational Safety and Health Administration and the EPA. We have incurred, and will continue to incur, capital and operating expenditures and other costs in the ordinary course of our business in complying with these laws and regulations.

We have international operations and assets and may have additional international operations and assets in the future. Our international operations and assets may be subject to various economic, social and governmental risks.

Our international operations and any future international operations may expose us to risks that could negatively impact our future results. Our operations may not develop in the same way or at the same rate as might be expected in a country with an economy similar to the United States. The additional risks that we may be exposed to in these cases include, but are not limited to:

- tariffs and trade barriers;
- currency fluctuations, which could decrease our revenues or increase our costs in United States dollars;
- regulations related to customs and import/export matters;
- tax issues, such as tax law changes and variations in tax laws;
- limited access to qualified staff;
- inadequate infrastructure;
- cultural and language differences;
- inadequate banking systems;
- different and/or more stringent environmental laws and regulations;
- restrictions on the repatriation of profits or payment of dividends;
- crime, strikes, riots, civil disturbances, terrorist attacks or wars;
- nationalization or expropriation of property;
- law enforcement authorities and courts that are weak or inexperienced in commercial matters; and
- deterioration of political relations among countries.

Table of Contents

The agricultural products of several of our operating subsidiaries are subject to disease outbreaks that can increase the cost of production and/or reduce production harvests, and the loss of existing organisms and germplasm would result in the loss of commercial technology.

Several of the products of our operating subsidiaries, including Trans Ova, Exemplar, AquaBounty and Okanagan, are subject to periodic outbreaks of a variety of diseases. Although these companies take measures to protect their stock, there can be no assurance that a disease will not damage or destroy existing organisms or germplasm. The economic impact of disease to our subsidiaries' production systems can be significant, as farmers must incur the cost of preventive measures, such as vaccines and antibiotics, and then if infected, the cost of lost or reduced harvests.

Our plans to pursue development and commercialization of adoptive cellular therapies based on CAR T-cell therapies, or CARs, are new approaches to cancer treatment that present significant challenges in a competitive landscape and the success of our efforts depends in large part on our owned and licensed intellectual property, and our efforts may be affected by litigation and developments in intellectual property law outside of our control.

Through our wholly owned subsidiary, Precigen, we intend to employ technologies licensed from the University of Texas MD Anderson Cancer Center, together with our existing suite of proprietary technologies, through our existing license with ZIOPHARM and internal programs, to pursue the development and commercialization of adoptive cellular therapies based on CARs under control of RheoSwitch technology targeting a variety of cancer malignancies. Because this is a newer approach to cancer immunotherapy and cancer treatment generally, developing and commercializing product candidates subjects us and our licensee to a number of challenges, including:

- obtaining regulatory approval from the FDA and other regulatory authorities that have very limited experience with the commercial development of genetically modified T-cell therapies for cancer;
- developing and deploying consistent and reliable processes for engineering a patient's T-cells ex vivo and infusing the engineered T-cells back into the patient;
- possibly conditioning patients with chemotherapy in conjunction with delivering each of the potential products, which may increase the risk of adverse side effects of the potential products;
- educating medical personnel regarding the potential side effect profile of each of the potential products, such as the potential adverse side effects related to cytokine release;
- developing processes for the safe administration of these potential products, including long-term follow-up for all patients who receive the potential products;
- sourcing additional clinical and, if approved, commercial supplies for the materials used to manufacture and process the potential products;
- developing a manufacturing process and distribution network with a cost of goods that allows for an attractive return on investment;
- establishing sales and marketing capabilities after obtaining any regulatory approval required to gain market access and acceptance;
- developing therapies for types of cancers beyond those addressed by the current potential products;
- not infringing the intellectual property rights, in particular, the patent rights, of third parties, including competitors developing alternative CAR T-cell therapies; and
- avoiding any applicable regulatory barriers to market, such as data and marketing exclusivities held by third parties, including competitors with approved CAR T-cell therapies.

We cannot be sure that T-cell immunotherapy technologies developed by Precigen or our licensee will yield satisfactory products that are safe and effective, scalable, or profitable.

Table of Contents

Because our gene therapy technology is novel, it is difficult to predict the time and cost of development and of subsequently obtaining regulatory approval.

There can be no assurance that we, including our subsidiaries and our collaborators, will not experience problems or delays in developing new product candidates and that such problems or delays will not cause unanticipated costs, or that any such development problems can be solved. We also may experience unanticipated problems or delays in expanding our manufacturing capacity, which may prevent the completion of clinical trials and the commercializing of products on a timely or profitable basis, if at all. For example, we, a collaborator or another group may uncover a previously unknown risk with any of our product candidates, and this may prolong the period of observation required for obtaining regulatory approval or may necessitate additional clinical testing.

In addition, the clinical trial requirements of the FDA, European Medicines Agency, or EMA, and other regulatory authorities and the criteria these regulators use when evaluating product candidates vary substantially according to the type, complexity, novelty and intended use and market of such product candidates. The regulatory approval process for novel product candidates such as ours can be more expensive and take longer than for other, better known or more extensively studied product candidates. Even if we and our collaborators are successful in developing product candidates, it is difficult to determine how long it will take or how much it will cost to obtain regulatory approvals in either the United States or the European Union or how long it will take to commercialize these product candidates. Regulatory requirements governing gene and cell therapy products have changed frequently and may continue to change in the future. For example, the FDA has established the Office of Cellular, Tissue and Gene Therapies within the Center for Biologics Evaluation and Research, or CBER, to consolidate the review of gene therapy and related products and has established the Cellular, Tissue and Gene Therapies Advisory Committee to advise CBER in its marketing application review process. Gene therapy clinical trials conducted at institutions that receive funding for recombinant DNA research from NIH also potentially are subject to review by the NIH office of Biotechnology Activities' Recombinant DNA Advisory Committee, or RAC; however, NIH has announced that the RAC will only publicly review clinical trials if the trials cannot be evaluated by standard oversight bodies and pose unusual risks. Although the FDA decides whether individual gene therapy protocols may proceed, the RAC public review process, if undertaken, can delay the initiation of a clinical trial, even if the FDA has reviewed the trial design and details and approved its initiation. Conversely, the FDA can put a clinical trial or an IND on clinical hold even if the RAC has provided a favorable review or an exemption from in-depth, public review. In addition, adverse developments in clinical trials of gene therapy products conducted by others may cause the FDA or other oversight bodies to change the requirements for approval of any of our product candidates and those of our collaborators. Navigating these various requirements and frameworks may require significant time and money, and compliance with these requirements does not guarantee regulatory approval of any marketing applications.

There is a high failure rate for drugs and biologics proceeding through clinical trials, at all stages of development. Results from preclinical studies or previous clinical trials are not necessarily predictive of future clinical trial results, and interim results of a clinical trial are not necessarily indicative of final results. Our product candidates and those of our collaborators may fail to show the desired results in clinical development despite demonstrating positive results in preclinical studies or having successfully advanced through initial clinical trials.

There is a high failure rate for drugs and biologics proceeding through clinical trials and may occur at any stage due to a multitude of factors both within and outside our control. Many companies in the pharmaceutical and biotechnology industries have suffered significant setbacks in late-stage clinical trials even after achieving promising results in preclinical testing and earlier-stage clinical trials. Data obtained from preclinical and clinical activities are subject to varying interpretations, which may delay, limit or prevent regulatory approval. In addition, we and our collaborators may experience regulatory delays or rejections as a result of many factors, including changes in regulatory policy during the period of product candidate development. Any such delays could materially and adversely affect our business, financial condition, results of operations and prospects. If clinical trials result in negative or inconclusive results, we or our collaborators may decide, or regulators may require us, to discontinue trials of the products or conduct additional clinical trials or preclinical studies.

Our and our collaborators' product candidates may cause undesirable side effects or have other properties that could delay or prevent their regulatory approval, limit the commercial potential or result in significant negative

consequences following any potential marketing approval.

There have been several significant adverse side effects in gene therapy treatments in the past, including reported cases of leukemia and death seen in other trials using other vectors. While new recombinant vectors and other approaches have been developed to reduce these side effects, gene therapy and synthetic biology therapy in general is still a relatively new approach

Table of Contents

to disease treatment and additional adverse side effects could develop. There also is the potential risk of delayed adverse events following exposure to these products due to persistent biologic activity of the genetic material or other components of products used to carry the genetic material.

Other possible adverse side effects that could occur with treatment with synthetic biology products include an immunologic reaction early after administration that, while not necessarily adverse to the patient's health, could substantially limit the effectiveness of the treatment. In previous clinical trials involving adeno-associated virus, vectors for gene therapy, some subjects experienced the development of a T-cell response, whereby after the vector is within the target cell, the cellular immune response system triggers the removal of transduced cells by activated T-cells. If similar effect occurs with our or our collaborators' products, we or our collaborators may decide or be required to halt or delay further clinical development of our product candidates.

Additionally, if any of our or our collaborators' product candidates receives marketing approval, the FDA could require us to adopt a REMS to ensure that the benefits outweigh its risks, which may include, among other things, a medication guide outlining the risks of the product for distribution to patients and a communication plan to health care practitioners. Such requirements could prevent us from achieving or maintaining market acceptance of our product candidates and could significantly harm our business, prospects, financial condition and results of operations.

We and our collaborators may find it difficult to enroll patients in clinical trials, which could delay or prevent us and our collaborators from proceeding with clinical trials.

Identifying and qualifying patients to participate in clinical trials of our and our collaborators' product candidates is critical to success. The timing of clinical trials depends on the ability to recruit patients to participate as well as completion of required follow-up periods. If patients are unwilling to participate in our or our collaborators' clinical studies for any number of reasons, such as because of negative publicity from adverse events related to the biotechnology or gene therapy fields, the timeline for recruiting patients, conducting clinical trials and obtaining regulatory approval may be delayed. These delays could result in increased costs, delays in advancing product candidates, or termination of the clinical trials altogether.

Even if we and our collaborators complete the necessary clinical trials, we cannot predict when, or if, we and our collaborators will obtain regulatory approval to commercialize a product candidate and the approval may be for a more narrow indication than we or our collaborators seek.

We and our collaborators cannot commercialize a product candidate until the appropriate regulatory authorities have reviewed and approved the product candidate. Even where product candidates meet their endpoints in clinical trials, the regulatory authorities may not complete their review processes in a timely manner, or may not grant regulatory approval. Additional delays may result if an FDA Advisory Committee or other regulatory authority recommends non-approval or restrictions on approval. In addition, we and our collaborators may experience delays or rejections based upon additional government regulation from future legislation or administrative action, or changes in regulatory authority policy during the period of product development, clinical trials and the review process.

Regulatory authorities also may approve a product candidate for more limited indications than requested or they may impose significant limitations in the form of narrow indications, warnings or a REMS. These regulatory authorities may require precautions or contra-indications with respect to conditions of use or they may grant approval subject to the performance of costly post-marketing clinical trials. In addition, regulatory authorities may not approve the labeling claims that are necessary or desirable for the successful commercialization of our product candidates. Any of the foregoing scenarios could materially harm the commercial prospects for our product candidates and materially and adversely affect our business, financial condition, results of operations and prospects.

Even if we or our collaborators obtain regulatory approval for a product candidate, the product will remain subject to regulatory oversight.

Even if we and our collaborators obtain regulatory approval for our product candidates, these candidates will be subject to ongoing regulatory requirements for manufacturing, labeling, packaging, storage, advertising, promotion, sampling, record-keeping and submission of safety and other post-market information. Regulatory approvals also may be subject to a REMS, limitations on the approved indicated uses for which the product may be marketed or to the conditions of approval, or contain requirements for potentially costly post-marketing testing, including Phase 4 clinical trials, and surveillance to monitor the quality, safety and efficacy of the product. For example, the holder of an

approved BLA is obligated to monitor and report adverse events and any failure of a product to meet the specifications in the BLA. The FDA guidance advises that patients treated with some types of gene therapy undergo follow-up observations for potential adverse events for as long as 15 years.

Table of Contents

The holder of an approved BLA also must submit new or supplemental applications and obtain FDA approval for certain changes to the approved product, product labeling or manufacturing process. Advertising and promotional materials must comply with FDA rules and are subject to FDA review, in addition to other potentially applicable federal and state laws.

In addition, product manufacturers and their facilities are subject to continual review and periodic inspections by the FDA and other regulatory authorities for compliance with cGMP requirements and adherence to commitments made in the United States or foreign marketing application. If we, our collaborators, or a regulatory authority discover previously unknown problems with a product, such as adverse events of unanticipated severity or frequency, or problems with the facility where the product is manufactured or disagrees with the promotion, marketing or labeling of that product, a regulatory authority may impose restrictions relative to that product, the manufacturing facility or us, including requiring recall or withdrawal of the product from the market or cessation of manufacturing.

If we fail to comply with applicable regulatory requirements following approval of any of our product candidates, a regulatory authority may take adverse actions, which include, among other things, a range of sanctions from issuing a warning letter to causing us to withdraw the product from the market.

In addition, the FDA's policies, and those of equivalent foreign regulatory agencies, may change and additional government regulations may be enacted that could prevent, limit or delay regulatory approval of our product candidates. We cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative action, either in the United States or abroad. If we are slow or unable to adapt to changes in existing requirements or the adoption of new requirements or policies, or if we are not able to maintain regulatory compliance, we may lose any marketing approval that we may have obtained and we may not achieve or sustain profitability, which would materially and adversely affect our business, financial condition, results of operations and prospects.

Our reliance on third parties, such as contract manufacturing organizations and contract or clinical research organizations, may result in delays in completing, or a failure to complete, non-clinical testing or clinical trials if they fail to perform under our agreements with them. Such failures could adversely affect our financial results and our commercial prospects.

In the course of product development, we may engage contract or clinical manufacturing organizations to supply us with our product candidates or products to be used in non-clinical and clinical testing and contract research organizations to conduct and manage non-clinical and clinical studies. We are responsible for ensuring that each of our clinical trials is conducted in accordance with the general investigational plan and protocols for the trial. Moreover, the FDA requires us to comply with GCPs for conducting, recording, and reporting the results of clinical trials to assure that data and reported results are credible and accurate and that the rights, integrity and confidentiality of trial participants are protected. Our reliance on third parties that we do not control does not relieve us of these responsibilities and requirements. If these third parties do not successfully carry out their contractual duties or regulatory obligations or meet expected deadlines, if the quality or accuracy of the data they obtain is compromised due to the failure to adhere to our clinical protocols or regulatory requirements or for other reasons, our clinical trials may be extended, delayed, suspended or terminated, and we may not be able to obtain regulatory approval for our product candidates.

In addition, if our third-party contract manufacturers and suppliers do not supply us with our product candidates or products in a timely fashion and in compliance with applicable quality and regulatory requirements, including cGMPs, or otherwise fail or refuse to comply with their obligations to us under our supply and manufacturing arrangements, we may not have adequate remedies for any breach, and their failure to supply us could impair or preclude our ability to meet our supply needs for non-clinical and clinical studies, including those being conducted in collaboration with our partners. Such failures could delay our product development efforts, and our business, operating results and financial condition could be adversely affected.

RISKS RELATED TO MANUFACTURING HUMAN THERAPEUTICS

Synthetic biology therapies are novel, complex and difficult to manufacture. We or our collaborators could experience production problems that result in delays in product development or commercialization programs or otherwise adversely affect our business.

The manufacturing processes that we and our collaborators use to produce synthetic biology product candidates for human therapeutics are complex, novel and have not been validated for commercial use. Several factors could cause production interruptions, including equipment malfunctions, facility contamination, raw material shortages or contamination, natural disasters, disruption in utility services, human error, or disruptions in the operations of our suppliers.

Table of Contents

Our and our collaborators' synthetic biology product candidates require processing steps that are more complex than those required for most chemical pharmaceuticals. Moreover, unlike chemical pharmaceuticals, the physical and chemical properties of a biologic often cannot be fully characterized. As a result, assays of the finished product may not be sufficient to ensure that the product will perform in the intended manner. Accordingly, it is necessary to employ multiple steps to control our manufacturing process to assure that the product candidate is made strictly and consistently in compliance with the process. Problems with the manufacturing process, even minor deviations from the normal process, could result in product defects or manufacturing failures that result in lot failures, product recalls, product liability claims or insufficient inventory. We or our collaborators may encounter problems achieving adequate quantities and quality of clinical-grade materials that meet FDA, EMA or other applicable standards or specifications with consistent and acceptable production yields and costs.

Any problems in our manufacturing process or facilities could make us a less attractive collaborator for potential partners, which could limit our access to additional attractive development programs.

Delays in obtaining regulatory approval of manufacturing processes and facilities or disruptions in manufacturing processes may delay or disrupt our commercialization efforts.

Before we or our collaborators can begin to commercially manufacture our product candidates for human therapeutics, we must obtain regulatory approval from the FDA for the applicable manufacturing process and facility. This likely will require the manufacturing facility to pass a pre-approval inspection by the FDA. A manufacturing authorization must also be obtained from the appropriate European Union regulatory authorities.

In order to obtain FDA approval, we will need to ensure that all of the processes, methods and equipment are compliant with cGMP and perform extensive audits of vendors, contract laboratories and suppliers. If any of our vendors, contract laboratories or suppliers is found to be out of compliance with cGMP, we may experience delays or disruptions in manufacturing while we work with these third parties to remedy the violation(s) or while we work to identify suitable replacement vendors. The cGMP requirements govern, among other things, quality control of the manufacturing process, raw materials, containers/closures, buildings and facilities, equipment, storage and shipment, labeling, laboratory activities, data integrity, documentation policies and procedures, and returns. In complying with cGMP, we will be obligated to expend time, money and effort in production, record keeping and quality control to assure that the product meets applicable specifications and other requirements. If we fail to comply with these requirements, we would be subject to possible regulatory action that could adversely affect our business, results of operations, financial condition and cash flows, including the inability to sell any products that we may develop.

Ethical, legal and social issues related to genetic testing may reduce demand for our product candidates, if approved.

We anticipate that prior to receiving certain cellular, gene, or other synthetic biology therapies, patients may be required to undergo genetic testing. Genetic testing has raised concerns regarding the appropriate utilization and the confidentiality of information provided by genetic testing. Genetic tests for assessing a person's likelihood of developing a chronic disease have focused public attention on the need to protect the privacy of genetic information. For example, concerns have been expressed that insurance carriers and employers may use these tests to discriminate on the basis of genetic information, resulting in barriers to the acceptance of genetic tests by consumers. This could lead to governmental authorities prohibiting genetic testing or calling for limits on or regulating the use of genetic testing, particularly for diseases for which there is no known cure. Any of these scenarios could decrease demand for our product candidates, if approved.

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

Ethical, social and legal concerns about cellular, gene or other synthetic biology therapies could result in additional regulations restricting or prohibiting our products. Even with the requisite approvals from the FDA in the United States, the EMA in the European Union, and other regulatory authorities internationally, the commercial success of product candidates will depend, in part, on the acceptance of physicians, patients and health care payors of synthetic biology therapy products in general, and our and our collaborators' product candidates in particular, as medically necessary, cost-effective and safe. Any product that we or our collaborators commercialize may not gain acceptance by physicians, patients, health care payors and others in the medical community. If these products do not achieve an adequate level of acceptance, we may or our collaborators may not generate significant product revenue to make the

products profitable.

Table of Contents

RISKS ASSOCIATED WITH OUR BUSINESS STRATEGY

The evolution of our business strategy may not be a successful strategy and may increase our capital requirements, increase our costs or otherwise harm our operating results and financial condition.

Our business strategy has evolved, and continues to evolve, toward relationships and structures that provide us with more control and ownership over the development process and commercialization path. This approach entails risks in implementation and operations and there is no guarantee that it will be successful. Furthermore, the changing focus of our business strategy may require additional capital beyond what we have historically used and what is available, and we may incur costs associated with the implementation and execution of our changing business strategy. In addition, as we perform our annual impairment tests, we will evaluate the impact of changes in our business strategy and, as a result, may incur impairment charges and write-offs and other related expenses, any of which, if material, could harm our operating results and financial condition.

If we fail to maintain and successfully manage our existing ECCs or JVs, we may not be able to develop and commercialize our technologies and achieve or sustain profitability.

We have entered into ECCs or JVs with strategic collaborators to develop products enabled by our technologies. There can be no guarantee that we can successfully manage these ECCs or JVs. We must use diligent efforts to carry out development activities under the ECCs. The exclusivity provisions of each ECC restrict our ability to commercialize our technologies in the designated field covered by the ECC. In most cases, the collaborator may terminate the ECC with us for any reason upon 90 days' notice. In all cases, the ECC may be terminated if we fail to exercise diligent efforts or breach, and fail to cure, other provisions of the ECC. In addition, since our efforts to date have focused on a small number of collaborators in certain targeted sectors, our business could be adversely affected if one or more of these collaborators terminate their ECCs or JVs, fail to use our technologies or fail to develop commercially viable products enabled by our technologies.

To the extent they continue to be part of our business, maintenance of ECCs and JVs also will subject us to other risks, including:

- we have relinquished important rights regarding the commercialization, marketing and distribution of products and we may disagree with our collaborators' plans in these areas;
- although we retain broad rights with respect to intellectual property developed under the ECCs, our collaborators have the right, under certain circumstances, to take control of the enforcement of such intellectual property;
- we may have lower revenues than if we were to develop, manufacture, market and distribute products enabled by our technologies ourselves;
- a collaborator could, without the use of our synthetic biology technologies, develop and market a competing product either independently or in collaboration with others, including our competitors;
- our collaborators could be undercapitalized or fail to secure sufficient resources to fund the development and/or commercialization of the products enabled by our technologies in accordance with the ECC;
- our collaborators could become unable or less willing to expend their resources on research and development or commercialization efforts with respect to our technologies due to general market conditions, their financial condition or other circumstances beyond our control;
- we may be unable to manage multiple simultaneous ECCs or JVs or fulfill our obligations with respect thereto;
- disagreements with a collaborator could develop and any conflict with a collaborator could reduce our ability to enter into future ECCs or JVs and negatively impact our relationships with one or more existing collaborators;
- our collaborators could terminate our ECC or JV with them, in which case, our collaborators may retain rights related to certain products, we may not be able to find another collaborator to develop different products in the field and we may not be able to develop different products in the field ourselves;
- our business could be negatively impacted if any of our collaborators undergo a change of control to a third party who is not willing to work with us on the same terms or commit the same resources as our current collaborator; and

Table of Contents

- our collaborators may operate in countries where their operations could be adversely affected by changes in the local regulatory environment or by political unrest.

If any of these events occur, or if we fail to maintain our ECCs or JVs with our collaborators, we may not be able to commercialize our existing and potential technologies, grow our business or generate sufficient revenues to support our operations.

Certain of our collaborators, including some businesses over which we have significant influence, will need additional capital.

In order for certain of our collaborators to execute on their business plans, they will have future capital requirements. We may be asked to, or need to, invest additional funds in these collaborators so that they can execute on their business plans. If we fail to invest such additional funds, the collaborator may not have sufficient capital to continue operations.

We rely on our collaborators to develop, commercialize and market certain products, and they may not be successful.

We depend on our collaborators to commercialize certain products enabled by our technologies. If our collaborators are not able to successfully develop the products enabled by our technologies, none of these enabled products will become commercially available and we will receive no back-end payments under our ECCs or JVs. Because we do not currently and may never possess the resources necessary to independently develop and commercialize all of the potential products that may result from our technologies, our ability to succeed in certain markets depends on our ability to develop and commercialize potential products through an ECC or JV. Some of our existing collaborators do not themselves have the resources necessary to commercialize products, and they in turn will need to rely on additional sources of financing or third-party collaborations. In addition, pursuant to our current ECCs or JVs and similar ECCs or JVs that we may enter into in the future, we have limited or no control over the amount or timing of resources that any collaborator is able or willing to devote to developing products or collaborative efforts. Any of our collaborators may fail to perform its obligations under the ECC. Our collaborators may breach or terminate their ECCs or JVs with us or otherwise fail to conduct their collaborative activities successfully and in a timely manner. If any of these events were to occur, our revenues, financial condition and results of operations could be adversely affected.

The sales process for strategic transactions or JVs may be lengthy and unpredictable, and we may expend substantial funds and management effort with no assurance of successfully entering into such transactions to commercialize our technologies.

Historically, the sales process for our ECCs and JVs has at times been lengthy and unpredictable. Our evolving focus on consummating strategic transactions and JVs may be equally or more challenging to consummate. Our sales and licensing efforts may require the effective demonstration of the benefits, value, differentiation, validation of our products, technologies and services and significant education and training of multiple personnel and departments within the potential collaborator's organization. We may expend substantial funds and management effort with no assurance that we will execute a transaction or otherwise sell our products, technologies or services. In addition, this lengthy sales cycle makes it more difficult for us to accurately forecast revenue in future periods and may cause revenues and operating results to vary significantly in such periods.

Many of our JVs, subsidiaries, and collaborators have no experience producing products at the commercial scale needed for the development of their business, and they will not succeed if they cannot effectively commercialize their products.

To develop products with our technologies, we or our JVs, subsidiaries, and collaborators must demonstrate the ability to utilize our technologies to produce desired products at the commercial scale and on an economically viable basis or they must collaborate with others to do so. The products and processes developed using our technologies may not perform as expected when applied at commercial scale, or we or our collaborators may encounter operational challenges for which we and they are unable to devise a workable solution. For example, contamination in the production process could decrease process efficiency, create delays and increase our collaborators' costs. Moreover, under the terms of our ECCs or JVs, we limit the ability of our collaborators to partner their programs with third parties. We and our collaborators may not be able to scale up our production in a timely manner, if at all, even if our collaborators successfully complete product development in their laboratories and pilot and demonstration facilities. If

this occurs, the ability to commercialize products and processes using our technologies will be adversely affected, and, with respect to any products that are brought to market, our JVs, subsidiaries, or collaborators may not be able to lower the cost of production, which would adversely affect our ability to increase the future profitability of our business.

Table of Contents

Markets in which we, our JVs, and collaborators are developing products using our technologies are subject to extensive regulation, and we rely on our JVs and collaborators to comply with all applicable laws and regulations. Our technologies are used in products that are subject to extensive regulation by governmental authorities. We depend on our JVs and collaborators to comply with these laws and regulations with respect to products they produce using our technologies, and we do not independently monitor whether our collaborators comply with applicable laws and regulations. If either we, our JVs or our collaborators fail to comply with applicable laws and regulations, we are subject to substantial financial and operating risks because, in addition to our own compliance, we also depend on our JVs and collaborators to produce the end products enabled by our technologies for sale and because, in many cases, we have, or in the future may have, a substantial equity interest in our JVs and collaborators. These regulatory risks are extensive and include the following:

- complying with these regulations, including seeking approvals, the uncertainty of the scope of future regulations, and the costs of continuing compliance with regulations, could affect our sales and profitability and that of our JVs and collaborators and materially impact our operating results;
- our business could be adversely affected if our processes and those used by our JVs and collaborators to manufacture their final products fail to be approved by the applicable regulatory authorities;
- where products are subject to regulatory approval, the regulatory approval process can be lengthy, costly, time consuming and inherently unpredictable, and if we and our JVs and collaborators are ultimately unable to obtain regulatory approval for products using our technologies, our business will be substantially harmed;
- even if we and our JVs and collaborators are able to commercialize products using our technologies, the product may become subject to post-approval regulatory requirements, unfavorable pricing regulations, third-party payor reimbursement practices or regulatory reform initiatives that could harm our business;
- we and our JVs and collaborators conduct on-going research and development that relies on evaluations in animals, which may become subject to bans or additional regulations;
- compliance with existing or future environmental laws and regulations could have a material adverse impact on the development and commercialization of products using our technologies; and
- to the extent products produced using our technologies are commercialized outside the United States, they will be subject to additional laws and regulations under the jurisdictions in which such products are commercialized.

The markets in which we and our collaborators are developing products using our technologies are highly competitive.

The markets in which we and our collaborators are developing products are, and will continue to be, highly competitive, and there can be no assurance that we or our collaborators will be able to compete effectively. There are numerous companies presently in these markets that are developing products that may compete with, and could adversely affect the prices for, any products developed by our collaborators using our technologies. Many of these competitors and potential competitors are well-established companies with significant resources and experience, along with well-developed distribution systems and networks for their products, valuable historical relationships with potential customers and extensive sales and marketing programs for their products. Some of these competitors may use these resources and their market influence to impede the development and/or acceptance of the products developed by our collaborators using our technologies.

To the extent that any of our collaborators' competitors are more successful with respect to any key competitive factor or our collaborators are forced to reduce, or are unable to raise, the price of any products enabled by our technologies in order to remain competitive, our operating results and financial condition could be materially adversely affected. Competitive pressure could arise from, among other things, safety and efficacy concerns, limited demand or a significant number of additional competitive products being introduced into a particular market, price reductions by competitors, the ability of competitors to capitalize on their economies of scale, the ability of competitors to produce or otherwise procure products similar or equivalent to those of our collaborators at lower costs and the ability of competitors to access more or newer technology than our collaborators can access (including our own).

Our right to terminate our ECCs is limited.

Generally, we do not have the right to terminate an ECC except in limited circumstances such as the collaborator's failure to exercise diligent efforts in performing its obligations under the ECC, including its development of products enabled by our

44

Table of Contents

technologies, or its breach of a term of the ECC that remains uncured for a specified period of time. Moreover, each of our collaborators receives an exclusive license to use all of our technologies in a designated field, potentially in perpetuity. The collaborators we choose in particular fields may not be in the best position to maximize the value of our technologies in that field, if they are capable of commercializing any products at all. In addition, the scope of the field for a particular ECC may prove to be too broad and result in the failure to maximize the value of our technologies in that field.

A significant portion of our business is conducted by JVs that we cannot operate solely for our benefit.

In JVs, we share ownership and management of a company with one or more parties who may not have the same goals, strategies, priorities or resources as we do and may compete with us outside the JV. JVs are intended to be operated for the benefit of all JV partners, rather than for our exclusive benefit. Operating a business as a JV often requires additional organizational formalities as well as time-consuming procedures for sharing information and making decisions. In JVs we are required to foster our relationships with our JV partners as well as promote the overall success of the JV, and if a JV partner changes or relationships deteriorate, our success in the JV may be materially adversely affected. The benefits from a successful JV are shared among the JV partners, so we do not receive all the benefits from our successful JVs. Moreover, as a partial owner of a JV, we are exposed to potential risks and liabilities that we do not face when we enter into an ECC.

RISKS RELATED TO OUR INTELLECTUAL PROPERTY

Our ability to compete may decline if we do not adequately protect our proprietary technologies or if we lose some of our intellectual property rights through costly litigation or administrative proceedings.

Our success depends in part on our ability to obtain patents and maintain adequate protection of our intellectual property in the United States and abroad for our suite of technologies and resultant products and potential products. We have adopted a strategy of seeking patent protection in the United States and abroad with respect to certain of the technologies used in or relating to our products and processes. We have also in-licensed rights to additional patents and pending patent applications in the United States and abroad. We intend to continue to apply for patents relating to our technologies, methods and products as we deem appropriate.

We have strategic positioning with respect to our key technologies including patent portfolios directed to: our switch technology covering aspects of our gene switches, such as our RheoSwitch Therapeutic System, and gene modulation systems, vectors, cells and organisms containing these switches, and their use; our activator ligand technology covering aspects of our activator ligands and their use; and our cell identification and selection technology covering aspects of our cell identification and selection platform, including our cell purification, isolation, characterization and manipulation technologies. We have also filed counterpart patents and patent applications in other jurisdictions, including Australia, Argentina, Brazil, Canada, China, Europe, Hong Kong, India, Indonesia, Israel, Japan, Korea, Mexico, New Zealand, Philippines, Russia, Singapore, South Africa and Taiwan. In the future, we may file in these or additional jurisdictions as deemed appropriate for the protection of our technologies.

The enforceability of patents, as well as the actual patent term and expiration thereof, involves complex legal and factual questions and, therefore, the extent of enforceability cannot be guaranteed. Issued patents and patents issuing from pending applications may be challenged, invalidated or circumvented. Moreover, the United States Leahy-Smith America Invents Act, enacted in September 2011, brought significant changes to the United States patent system, which include a change to a "first to file" system from a "first to invent" system and changes to the procedures for challenging issued patents and disputing patent applications during the examination process, among other things. These changes could increase the costs and uncertainties surrounding the prosecution of our patent applications and the enforcement or defense of our patent rights. Additional uncertainty may result from legal precedent handed down by the United States Court of Appeals for the Federal Circuit and United States Supreme Court as they determine legal issues concerning the scope and construction of patent claims and inconsistent interpretation of patent laws by the lower courts. Accordingly, we cannot ensure that any of our pending patent applications will result in issued patents, or even if issued, predict the breadth of the claims upheld in our and other companies' patents. Given that the degree of future protection for our proprietary rights is uncertain, we cannot ensure that we were the first to invent the inventions covered by our pending patent applications; we were the first to file patent applications for these inventions; the patents we have obtained, particularly certain patents claiming nucleic acids, proteins, or methods, are

valid and enforceable; and the proprietary technologies we develop will be patentable.

In addition, unauthorized parties may attempt to copy or otherwise obtain and use our products or technology. Monitoring unauthorized use of our intellectual property is difficult, and we cannot be certain that the steps we have taken will prevent unauthorized use of our technologies, particularly in certain foreign countries where the local laws may not protect our proprietary rights as fully as in the United States. Moreover, third parties could practice our inventions in territories where we

Table of Contents

do not have patent protection. Such third parties may then try to import into the United States or other territories products, or information leading to potentially competing products, made using our inventions in countries where we do not have patent protection for those inventions. If competitors are able to use our technologies, our ability to compete effectively could be harmed. Moreover, others may independently develop and obtain patents for technologies that are similar to or superior to our technologies. If that happens, we may need to license these technologies, and we may not be able to obtain licenses on reasonable terms, if at all, which could harm our business.

We also rely on trade secrets to protect our technologies, especially in cases when we believe patent protection is not appropriate or obtainable. However, trade secrets are difficult to protect. While we require our employees, academic collaborators, collaborators, consultants and other contractors to enter into confidentiality agreements, we may not be able to adequately protect our trade secrets or other proprietary or licensed information. If we cannot maintain the confidentiality of our proprietary and licensed technologies and other confidential information, our ability and that of our licensor to receive patent protection and our ability to protect valuable information owned or licensed by us may be imperiled. Enforcing a claim that a third-party entity illegally obtained and is using any of our trade secrets is expensive and time consuming, and the outcome is unpredictable. Moreover, our competitors may independently develop equivalent knowledge, methods and know-how.

Litigation or other proceedings or third-party claims of intellectual property infringement could require us to spend significant time and money and could prevent us from commercializing our technologies or impact our stock price.

Our commercial success also depends in part on not infringing patents and proprietary rights of third parties and not breaching any licenses or other agreements that we have entered into with regard to our technologies, products and business. We cannot ensure that patents have not been issued to third parties that could block our or our collaborators' ability to obtain patents or to operate as we would like. There may be patents in some countries that, if valid, may block our ability to make, use or sell our products in those countries, or import our products into those countries, if we are unsuccessful in circumventing or acquiring the rights to these patents. There also may be claims in patent applications filed in some countries that, if granted and valid, also may block our ability to commercialize products or processes in these countries if we are unable to circumvent or license them.

The biotechnology industry is characterized by frequent and extensive litigation regarding patents and other intellectual property rights. Many companies have employed intellectual property litigation as a way to gain a competitive advantage. Our involvement in litigation, interferences, opposition proceedings or other intellectual property proceedings inside and outside of the United States, to defend our intellectual property rights or as a result of alleged infringement of the rights of others, may divert management's time from focusing on business operations and could cause us to spend significant amounts of money. Some of our competitors may have significantly greater resources and, therefore, they are likely to be better able to sustain the cost of complex patent or intellectual property litigation than we could. The uncertainties associated with litigation could have a material adverse effect on our ability to raise the funds necessary to continue our business or to enter into additional collaborations with others.

Furthermore, any potential intellectual property litigation also could force us or our collaborators to do one or more of the following:

- stop selling, incorporating or using products that use the intellectual property at issue;
- obtain from the third party asserting its intellectual property rights a license to sell or use the relevant technology, which license may not be available on reasonable terms, if at all; or
- redesign those products or processes that use any allegedly infringing technology, or relocate the operations relating to the allegedly infringing technology to another jurisdiction, which may result in significant cost or delay to us, or that could be technically infeasible.

The patent landscape in the field of synthetic biology is particularly complex. We are aware of United States and foreign patents and pending patent applications of third parties that cover various aspects of synthetic biology including patents that some may view as covering aspects of our technologies. In addition, there may be patents and patent applications in the field of which we are not aware. In many cases, the technologies we develop are early-stage technologies, and we and our collaborators are just beginning the process of designing and developing products using these technologies. Although we will seek to avoid pursuing the development of products that may infringe any patent claims that we believe to be valid and enforceable, we and our collaborators may fail to do so. Moreover, given the

breadth and number of claims in patents and pending patent applications in the field of synthetic biology and the complexities and uncertainties associated with them, third parties may allege that we or our collaborators are infringing upon patent claims even if we do not believe such claims to be valid and enforceable.

Table of Contents

Except for claims we believe will not be material to our financial results, no third party has asserted a claim of infringement against us. Others may hold proprietary rights that could prevent products using our technologies from being marketed. Any patent-related legal action against persons who license our technologies, our collaborators or us claiming damages and seeking to enjoin commercial activities relating to products using our technologies or our processes could subject us to potential liability for damages and require our licensor or us to obtain a license to continue to manufacture or market such products or any future product candidates that use our technologies. We cannot predict whether we or our licensor would prevail in any such actions or that any license required under any of these patents would be made available on commercially acceptable terms, if at all. In addition, we cannot be sure that any such products or any future product candidates or processes could be redesigned to avoid infringement, if necessary. Accordingly, an adverse determination in a judicial or administrative proceeding, or the failure to obtain necessary licenses, could prevent our collaborators from developing and commercializing products using our technologies, which could harm our business, financial condition and operating results.

If any of our competitors have filed patent applications or obtained patents that claim inventions also claimed by us, we may have to participate in interference proceedings declared by the USPTO to determine priority of invention and, thus, the right to the patents for these inventions in the United States. These proceedings could result in substantial cost to us even if the outcome is favorable. Even if successful, an interference may result in loss of certain of our important claims.

Any litigation or proceedings could divert our management's time and efforts. Even unsuccessful claims could result in significant legal fees and other expenses, diversion of management's time, and disruption in our business. Uncertainties resulting from initiation and continuation of any patent or related litigation could harm our ability to compete.

Obtaining and maintaining our patent protection depends on compliance with various procedural, document submission, fee payment and other requirements imposed by governmental patent agencies, and our patent protection could be reduced or eliminated for non-compliance with these requirements.

The USPTO and various foreign governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other provisions during the patent process. Given the size of our intellectual property portfolio, compliance with these provisions involves significant time and expense. There are situations in which noncompliance can result in abandonment or lapse of a patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. In such an event, competitors might be able to enter the market earlier than would otherwise have been the case.

If we do not obtain additional protection under the Hatch-Waxman Amendments, other United States legislation, and similar foreign legislation by extending the patent terms and obtaining regulatory exclusivity for our technologies, our business may be materially harmed.

Depending upon the timing, duration and specifics of FDA marketing approval of products using our technologies, one or more of the United States patents we own or license may be eligible for limited patent term restoration under the Hatch-Waxman Amendments. The Hatch-Waxman Amendments permit a patent restoration term of up to five years as compensation for patent term lost during product development and the FDA regulatory review process. However, we may not be granted an extension because of, for example, failing to apply within applicable deadlines, failing to apply prior to expiration of relevant patents or otherwise failing to satisfy applicable requirements. Moreover, the applicable time period or the scope of patent protection afforded could be less than we request. If we are unable to obtain patent term extension or restoration or the term of any such extension is less than we request, our competitors may obtain approval of competing products following our patent expiration, and our ability to generate revenues could be materially adversely affected.

Some of our products may not have patent protection and, as a result, potential competitors face fewer barriers in introducing competing products. We and our collaborators may rely on trade secrets and other unpatented proprietary information to protect our commercial position with respect to such products, which we may be unable to do. In some instances, we and our collaborators may also rely on regulatory exclusivity, including orphan drug exclusivity, to protect our products from competition. Some of our or our collaborators' products may be subject to the BPCIA, which may provide those products exclusivity that prevents approval of a biosimilar product that references the data in

one of our BLAs in the United States for 12 years after approval. However, the BPCIA and other regulatory exclusivity frameworks may evolve over time based on statutory changes, FDA issuance of new regulations, and judicial decisions. In addition, the BPCIA exclusivity period does not prevent another company from independently developing a product that is highly similar to an approved product, generating all the data necessary for a full BLA and seeking approval. BPCIA exclusivity only assures that another company cannot rely on the innovator company's data and the FDA's prior approvals to support the biosimilar product's approval. As a result, it is possible that a potential competing drug product might obtain FDA approval before applicable exclusivity periods have expired.

Table of Contents

Enforcing our intellectual property rights may be difficult and unpredictable.

If we were to initiate legal proceedings against a third party to enforce a patent claiming one of our technologies, the defendant could counterclaim that our patent is invalid and/or unenforceable or assert that the patent does not cover its manufacturing processes, manufacturing components or products. Proving patent infringement may be difficult, especially where it is possible to manufacture a product by multiple processes. Furthermore, in patent litigation in the United States, defendant counterclaims alleging both invalidity and unenforceability are commonplace. Although we believe that we have conducted our patent prosecution in accordance with the duty of candor and in good faith, the outcome following legal assertions of invalidity and unenforceability during patent litigation is unpredictable. With respect to the validity of our patent rights, we cannot be certain, for example, that there is no invalidating prior art, of which we and the patent examiner were unaware during prosecution. If a defendant were to prevail on a legal assertion of invalidity and/or unenforceability, we would not be able to exclude others from practicing the inventions claimed therein. Such a loss of patent protection could have a material adverse impact on our business. Even if our patent rights are found to be valid and enforceable, patent claims that survive litigation may not cover commercially valuable products or prevent competitors from importing or marketing products similar to our own, or using manufacturing processes or manufacturing components similar to those used to produce the products using our technologies.

Although we believe we have obtained assignments of patent rights from all inventors, if an inventor did not adequately assign their patent rights to us, a third party could obtain a license to the patent from such inventor. This could preclude us from enforcing the patent against such third party.

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

The laws of some foreign countries do not protect intellectual property rights to the same extent as the laws of the United States. Many companies have encountered significant problems in protecting and defending intellectual property rights in certain foreign jurisdictions. The legal systems of certain countries, particularly certain developing countries, do not favor the enforcement of patents and other intellectual property protection, particularly those relating to synthetic biology. This could make it difficult for us to stop the infringement of our patents or misappropriation of our other intellectual property rights. Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial costs and divert our efforts and attention from other aspects of our business. Accordingly, our efforts to protect our intellectual property rights in such countries may be inadequate.

If our technologies or products using our technologies are stolen, misappropriated or reverse engineered, others could use the technologies to produce competing technologies or products.

Third parties, including our collaborators, contract manufacturers, contractors and others involved in our business, often have access to our technologies. If our technologies, or products using our technologies, were stolen, misappropriated or reverse engineered, they could be used by other parties that may be able to reproduce our technologies or products using our technologies, for their own commercial gain. If this were to occur, it would be difficult for us to challenge this type of use, especially in countries with limited intellectual property protection.

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

We have taken measures to protect our trade secrets and proprietary information, but these measures may not be effective. We require our new employees and consultants to execute confidentiality agreements upon the commencement of an employment or consulting arrangement with us. These agreements generally require that all confidential information developed by the individual or made known to the individual by us during the course of the individual's relationship with us be kept confidential and not disclosed to third parties. These agreements also generally provide that inventions conceived by the individual in the course of rendering services to us shall be our exclusive property. Nevertheless, our proprietary information may be disclosed, third parties could reverse engineer our technologies or products using our technologies, and others may independently develop substantially equivalent proprietary information and techniques or otherwise gain access to our trade secrets. 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.

Table of Contents

RISKS RELATED TO OUR COMMON STOCK

We do not anticipate paying cash dividends, and accordingly, shareholders should rely on stock appreciation for return on their investment.

We have never declared or paid cash dividends on our capital stock. We do not anticipate paying cash dividends in the future and intend to retain all of our future earnings, if any, to finance the operations, development and growth of our business. As a result, appreciation of the price of our common stock, which may never occur, will provide a return to shareholders. Investors seeking cash dividends should not invest in our common stock. We have on two occasions distributed equity securities to our shareholders as a special stock dividend: 17,830,305 shares of ZIOPHARM common stock were distributed in June 2015 and 1,776,557 shares of AquaBounty common stock were distributed in January 2017. However, it is possible that we may never declare a special dividend again, and shareholders should not rely upon potential future special dividends as a source of return on their investment.

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

Our stock price has been, and is likely to continue to be, volatile. The market price of our common stock could fluctuate significantly for many reasons, including in response to the risks described in this "Risk Factors" section, or for reasons unrelated to our operations, such as reports by media or industry analysts, investor perceptions or negative announcements by our collaborators regarding their own performance, as well as industry conditions and general financial, economic and political instability. From January 1, 2017 through February 15, 2019, our common stock has traded as high as $26.99 per share and as low as $6.21 per share. The stock market in general, as well as the market for biopharmaceutical companies in particular, has experienced extreme volatility that has often been unrelated to the operating performance of particular companies. The market price of our common stock may be influenced by many factors, including, among others:

- announcements of acquisitions, collaborations, financings or other transactions by us;
- public concern as to the safety of our products;
- termination or delay of a development program;
- the recruitment or departure of key personnel; and
- the other factors described in this "Risk Factors" section.

If securities or industry analysts do not publish research or reports, or publish inaccurate or unfavorable research or reports about our business, our share price and trading volume could decline.

The trading market for our shares of common stock depends, in part, on the research and reports that securities or industry analysts publish about us or our business. We do not have any control over these analysts. If securities or industry analysts do not continue to cover us, the trading price for our shares of common stock may be negatively impacted. If one or more of the analysts who covers us downgrades our shares of common stock, changes their opinion of our shares or publishes inaccurate or unfavorable research about our business, our share price would likely decline. If one or more of these analysts ceases coverage of us or fails to publish reports on us regularly, demand for our shares of common stock could decrease and we could lose visibility in the financial markets, which could cause our share price and trading volume to decline.

The issuance of our common stock pursuant to a share lending agreement, including sales of the shares that we lend, and other market activity related to the share lending agreement may lower the market price of our common stock.

In connection with our offering of the Convertible Notes in July 2018, we entered into a share lending agreement with J.P. Morgan Securities LLC (that we refer to when acting in this capacity as the "share borrower"), the underwriter for our offering, pursuant to which we agreed to lend up to 7,479,431 shares of our common stock to the share borrower. We were informed by the share borrower that it or one of its affiliates intended to use the short position created by the share loan and the concurrent short sales of the borrowed shares to facilitate transactions by which investors in the Convertible Notes, or the Convertible Notes Investors, hedge their investments through short sales or privately negotiated derivatives transactions.

The existence of the share lending agreement in connection with the offering of the borrowed shares, the short sales of our common stock effected in connection with the sale of the Convertible Notes and the related derivatives transactions, or any unwind of such short sales or derivatives transactions, could cause the market price of our common stock to be lower over the term of the share

49

Table of Contents

lending agreement than it would have been had we not entered into that agreement, due to the effect of the increase in the number of outstanding shares of our common stock or otherwise. For example, in connection with any cash settlement of any such derivative transaction, the share borrower or its affiliates may purchase shares of our common stock and the Convertible Notes Investors may sell shares of our common stock, which could temporarily increase, temporarily delay a decline in, or temporarily decrease, the market price of our common stock. The market price of our common stock could be further negatively affected by these or other short sales of our common stock, including other sales by the Convertible Notes Investors hedging their investment therein.

Adjustments by the Convertible Notes Investors of their hedging positions in our common stock and the expectation thereof may have a negative effect on the market price of our common stock.

The borrowed shares are used by the Convertible Notes Investors to establish hedged positions with respect to our common stock through short sale transactions or privately negotiated derivative transactions. The number of borrowed shares may be more or less than the number of shares that will be needed in such hedging transactions. Any buying or selling of shares of our common stock by those Convertible Notes Investors to adjust their hedging positions may affect the market price of our common stock.

In addition, the existence of the Convertible Notes may also encourage short selling by market participants because the conversion of the Convertible Notes could depress our common stock price. The price of our common stock could be affected by possible sales of our common stock by the Convertible Notes Investors who view the Convertible Notes as a more attractive means of equity participation in us and by hedging or arbitrage trading activity that we expect to occur involving our common stock. This hedging or arbitrage trading activity could, in turn, affect the market price of the Convertible Notes.

Changes in the accounting guidelines relating to the borrowed shares or our inability to classify the borrowed shares as equity could decrease our reported earnings per share and potentially our common stock price.

Because the borrowed shares (or identical shares) must be returned to us when the share lending agreement terminates pursuant to its terms (or earlier in certain circumstances), we believe that under generally accepted accounting principles in the United States, or U.S. GAAP, as presently in effect, assuming the borrowed shares issued pursuant to the share lending agreement are classified as equity under U.S. GAAP, the borrowed shares will not be considered outstanding for the purpose of computing and reporting our earnings per share. If accounting guidelines were to change in the future or we are unable to classify the borrowed shares issued pursuant to the share lending agreement as equity, we may be required to treat the borrowed shares as outstanding for purposes of computing earnings per share, our reported earnings per share would be reduced and our common stock price could decrease, possibly significantly.

If our executive officers and directors choose to act together, they may be able to significantly influence our management and operations, acting in their own best interests and not necessarily those of other shareholders.

As of December 31, 2018, our executive officers and directors owned approximately 45 percent of our voting common stock, including shares subject to outstanding options; restricted stock units, or RSUs; and warrants. As a result, these shareholders, acting together, would be able to significantly influence all matters requiring approval by our shareholders, including the election of directors and the approval of mergers or other business combination transactions, as well as our management and affairs. The interests of this group of shareholders may not always coincide with the interests of other shareholders, and they may act in a manner that advances their best interests and not necessarily those of other shareholders. This concentration of ownership control may:

- delay, defer or prevent a change in control;
- entrench our management and/or the board of directors; or
- impede a merger, consolidation, takeover or other business combination involving us that other shareholders may desire.

We have engaged in transactions with companies in which Randal J. Kirk, our Chief Executive Officer, and his affiliates have an interest.

We have engaged in a variety of transactions, including ECCs, with companies in which Mr. Kirk and affiliates of Mr. Kirk have a direct or indirect interest. See "Notes to the Consolidated Financial Statements - Notes 4, 5, 7, 14 and 17" appearing elsewhere in this Annual Report for a discussion of such transactions. Mr. Kirk serves as the Senior Managing Director and Chief Executive Officer of Third Security and owns 100 percent of the equity interests of

Third Security. We believe that each

Table of Contents

of these transactions was on terms no less favorable to us than terms we could have obtained from unaffiliated third parties, and each of these transactions was approved by at least a majority of the disinterested members of the audit committee of our board of directors. In addition, subsequent to our consummation of the ECCs with certain related parties, Mr. Kirk and his affiliates invested in these companies. Furthermore, as we execute on these ECCs or JVs going forward, a conflict may arise between our interests and those of Mr. Kirk and his affiliates.

As of December 31, 2018, Randal J. Kirk controlled approximately 42 percent of our common stock and is able to control or significantly influence corporate actions, which may result in Mr. Kirk taking actions contrary to the desires of our other shareholders.

We have historically been controlled, managed and principally funded by Randal J. Kirk, our Chairman and Chief Executive Officer, and affiliates of Mr. Kirk, including Third Security. As of December 31, 2018, Mr. Kirk and shareholders affiliated with him beneficially owned approximately 42 percent of our voting stock. Mr. Kirk is able to control or significantly influence all matters requiring approval by our shareholders, including the election of directors and the approval of mergers or other business combination transactions. The interests of Mr. Kirk may not always coincide with the interests of other shareholders, and he may take actions that advance his personal interests and are contrary to the desires of our other shareholders.

Our articles of incorporation authorize us to issue preferred stock with terms that are preferential to those of our common stock.

Our articles of incorporation authorize us to issue, without the approval of our shareholders, one or more classes or series of preferred stock having such designations, preferences, limitations and relative rights, including preferences over our common stock respecting dividends and distributions, as our board of directors may determine. For example, in connection with the formation of a Preferred Stock Equity Facility, which was subsequently terminated in June 2018, we filed an amendment to our articles of incorporation to set the designations of our Series A Preferred Stock, which, if and when issued, would have certain preferences over our common stock, including accrued dividends of 8 percent per annum and, subject to limited exceptions, seniority to our common stock with respect to the rights to the payment of dividends and on parity with our common stock with respect to the distribution of our assets in the event of a liquidation, dissolution, or winding up or change of control. In the future, we may enter into similar facilities or issue preferred stock that have greater rights, preferences and privileges than our common stock.

A significant portion of our total outstanding shares of common stock is restricted from immediate resale but may be sold into the market in the near future. This could cause the market price of our common stock to drop significantly, even if our business is doing well.

Sales of a substantial number of shares of our common stock in the public market could occur at any time. These sales, or the perception in the market that the holders of a large number of shares of common stock intend to sell shares, could reduce the market price of our common stock. If Mr. Kirk or any of his affiliates were to sell a substantial portion of the shares they hold, it could cause our stock price to decline.

In addition, as of December 31, 2018, there were 11,093,063 shares subject to outstanding options that will become eligible for sale in the public market to the extent permitted by any applicable vesting requirements, lock-up agreements and Rules 144 and 701 under the Securities Act of 1933, as amended. As of December 31, 2018, there were 970,341 RSUs outstanding. Shares issuable upon the exercise of such options and upon vesting of the RSUs can be freely sold in the public market upon issuance and once vested. Additionally, as of December 31, 2018, we had 5,086,700 of shares available for grant under the 2013 Omnibus Incentive Plan.

We are subject to anti-takeover provisions in our articles of incorporation and bylaws and under Virginia law that could delay or prevent an acquisition of our Company, even if the acquisition would be beneficial to our shareholders.

Certain provisions of Virginia law, the commonwealth in which we are incorporated, and our articles of incorporation and bylaws could hamper a third party's acquisition of us, or discourage a third party from attempting to acquire control of us. These provisions include:

- a provision allowing our board of directors to issue preferred stock with rights senior to those of the common stock without any vote or action by the holders of our common stock. The issuance of preferred stock could adversely affect the rights and powers, including voting rights, of the holders of common stock;

51

Table of Contents

- establish advance notice requirements for nominations for election to the board of directors or for proposing matters that can be acted on at shareholder meetings;
- the inability of shareholders to convene a shareholders' meeting without the support of shareholders owning together 25 percent of our common stock;
- the application of Virginia law prohibiting us from entering into a business combination with the beneficial owner of 10 percent or more of our outstanding voting stock for a period of three years after the 10 percent or greater owner first reached that level of stock ownership, unless we meet certain criteria;
- allow the authorized number of our directors to be changed only by resolution of our board of directors;
- limit the manner in which shareholders can remove directors from the board;
- require that shareholder actions must be effected at a duly called shareholder meeting and prohibit actions by our shareholders by written consent; and
- limit who may call a special meeting of shareholders.

These provisions also could limit the price that certain investors might be willing to pay in the future for shares of our common stock. In addition, these provisions make it more difficult for our shareholders, should they choose to do so, to remove our board of directors or management.

If we fail to maintain an effective system of internal control over financial reporting, we may not be able to accurately report our financial results or prevent fraud. As a result, shareholders could lose confidence in our financial and other public reporting, which would harm our business and the trading price of our common stock.

Effective internal controls over financial reporting are necessary for us to provide reliable financial reports and, together with adequate disclosure controls and procedures, are designed to prevent fraud. Any failure to implement required new or improved controls, or difficulties encountered in their implementation, could cause us to fail to meet our reporting obligations. In addition, any testing by us conducted in connection with Section 404 of the Sarbanes-Oxley Act, or any subsequent testing by our independent registered public accounting firm, may reveal deficiencies in our internal controls over financial reporting that are deemed to be material weaknesses or that may require prospective or retroactive changes to our financial statements or identify other areas for further attention or improvement. Inferior internal controls could also cause investors to lose confidence in our reported financial information, which could have a negative effect on the trading price of our common stock.

We have previously reported material weaknesses in our internal control over financial reporting. As discussed in Part II, Item 9A, "Controls and Procedures", during the second quarter of 2018 we identified and disclosed a material weakness in our controls over the adoption of ASC 606, Revenue from Contracts with Customers, or ASC 606. Based upon the remediation actions described in such section, management has concluded that such material weakness has been remediated as of December 31, 2018. Although we believe we have taken appropriate actions to remediate the control deficiencies we have identified and to strengthen our internal control over financial reporting, we cannot assure you that we will not discover other material weaknesses in the future.

Item 1B. Unresolved Staff Comments

Not applicable.

Table of Contents

Item 2. Properties

We establish the geographic locations of our research and development operations based on proximity to the relevant market expertise and access to available talent pools. The following table shows information about our primary lab operations as of December 31, 2018:

Location	Square Footage
Germantown, Maryland	56,258
South San Francisco, California	55,609
Davis, California	32,867
San Diego, California	23,409
Budapest, Hungary	18,367
Ghent, Belgium	14,198
Campinas, Brazil	12,530
Oxford, England	10,000

Our primary domestic production facilities are located in Sioux Center, Iowa, and include approximately 281,000 square feet of production and office facilities and approximately 360 acres of land. The land and production facilities are primarily used for embryo transfer and in vitro fertilization processes, as well as housing livestock used in such processes. We also lease or own regional production facilities and land in California, Maryland, Missouri, New York, Oklahoma, South Dakota, Texas, and Washington for these purposes. Additionally, we are scaling up commercial production of our non-browning apples in Washington and our AAS salmon in Canada in anticipation of generating future revenues from each of these product lines.

We lease an additional 36,000 square feet of administrative offices in South San Francisco, California; West Palm Beach, Florida; Germantown, Maryland; and Blacksburg, Virginia. The terms of our leases range from one to ten years. See also "Management's Discussion and Analysis of Financial Condition and Results of Operations — Contractual Obligations and Commitments" appearing elsewhere in this Annual Report.

Item 3. Legal Proceedings

In March 2012, Trans Ova was named as a defendant in a licensing and patent infringement suit brought by XY, LLC, or XY, alleging that certain of Trans Ova's activities breached a 2004 licensing agreement and infringed on patents that XY allegedly owned. Trans Ova filed a number of counterclaims in the case. In Colorado District Court, the matter proceeded to a jury trial in January 2016. The jury determined that XY and Trans Ova had each breached the licensing agreement and that Trans Ova had infringed XY's patents. In April 2016, the court issued its post-trial order, awarding $0.5 million in damages to Trans Ova and $6.1 million in damages to XY. The order also provided Trans Ova with a compulsory license to XY's technology, subject to an ongoing royalty obligation. Both parties appealed the district court's order, which appeal was decided in May 2018 by the Court of Appeals for the Federal Circuit. The Court denied Trans Ova's appeal of its claims for antitrust, breach of contract and patent invalidity (except as to one patent, for which the Court affirmed invalidity in a separate, same-day ruling in a third-party case). The Court considered the issue of willfulness to be moot since the district court did not award damages for the willfulness finding. Finally, the Court remanded the district court's calculation of the ongoing royalty and instructed the district court to re-calculate the ongoing royalty in light of post-verdict economic factors.

Since the inception of the 2004 agreement, Trans Ova has remitted payments to XY pursuant to the terms of that agreement, or pursuant to the terms of the April 2016 court order, and has recorded these payments in cost of services in the consolidated statements of operations for the respective periods. For the period from inception of the 2004 agreement through the court's April 2016 order, aggregate royalty and license payments were $3.2 million, of which $2.8 million had not yet been deposited by XY. In 2016, we recorded the expense of $4.2 million, representing the excess of the net damages awarded to XY, including prejudgment interest, over the liability previously recorded by Trans Ova for uncashed checks previously remitted to XY. In August 2016, Trans Ova deposited the net damages amount, including prejudgment interest, into the court's treasury, to be held until the appeals process is complete and final judgment amounts are determined. As of December 31, 2018, this amount is included in restricted cash on the accompanying consolidated balance sheet appearing elsewhere in this Annual Report.

In December 2016, Trans Ova elected to void the outstanding checks discussed above, and these amounts have been reclassified to other accrued liabilities on the accompanying consolidated balance sheets as of December 31, 2018 and 2017, appearing elsewhere in this Annual Report.

Table of Contents

In December 2016, XY filed a complaint for patent infringement and trade secret misappropriation against Trans Ova in the District Court of Waco, Texas. Since the claims in this 2016 complaint directly relate to the 2012 licensing dispute and patent issues, Trans Ova filed and was granted a motion for change of venue to Colorado District Court. Trans Ova also filed a motion to dismiss, from which the Court dismissed ten of the twelve counts of the complaint. Presently, two counts for patent infringement remain pending. Trans Ova and we could elect to enter into a settlement agreement in order to avoid the further costs and uncertainties of litigation.

We may become subject to other claims, assessments and governmental investigations from time to time in the ordinary course of business. Such matters are subject to many uncertainties and outcomes are not predictable with assurance. We accrue liabilities for such matters when it is probable that future expenditures will be made and such expenditures can be reasonably estimated. We do not believe that any such matters, individually or in the aggregate, will have a material adverse effect on our business, financial condition, results of operations, or cash flows.

Item 4. Mine Safety Disclosures

Not applicable.

Table of Contents

PART II

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

Market Information and Holders of Record

Our common stock trades on the Nasdaq Global Select Market, or NASDAQ, under the symbol "XON".

As of February 15, 2019, we had 291 holders of record of our common stock. The actual number of shareholders is greater than this number of record holders and includes shareholders who are beneficial owners but whose shares are held in street name by brokers and other nominees. This number of holders of record also does not include shareholders whose shares may be held in trust by other entities.

Dividends

We have never declared or paid any cash dividends on our capital stock. We currently intend to retain earnings, if any, to finance the growth and development of our business and do not expect to pay any cash dividends on our common stock in the foreseeable future.

Securities Authorized for Issuance Under Equity Compensation Plans

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

Stock Performance Graph

This performance graph shall not be deemed "soliciting material" or to be "filed" with the SEC for purposes of Section 18 of the Securities Exchange Act of 1934, or otherwise subject to the liabilities under that Section, and shall not be deemed to be incorporated by reference into any filing of Intrexon Corporation under the Securities Act of 1933, as amended, or the Exchange Act.

The following graph shows a comparison from December 31, 2013 through December 31, 2018 of the cumulative total return for our common stock; the Standard & Poor's 500 Stock Index, or the S&P 500 Index; the NYSE MKT ARCA Biotechnology Index; and the NASDAQ Biotechnology Index. The graph assumes that $100 was invested at the market close on December 31, 2013 in the common stock of Intrexon Corporation, the S&P 500 Index, the NYSE MKT ARCA Biotechnology Index, and the NASDAQ Biotechnology Index, and data for the S&P 500 Index, the NYSE MKT ARCA Biotechnology Index, and the NASDAQ Biotechnology Index assumes reinvestments of dividends. The NASDAQ Biotechnology Index is now included in this comparison as a result of Intrexon's inclusion in the index beginning December 24, 2018. We have elected to replace the NYSE MKT ARCA Biotechnology Index with the NASDAQ Biotechnology Index because we believe that it is a more appropriate comparison. In this transition year, the stock performance graph below includes the comparative performance of the new index and the previously reported index. The stock price performance of the following graph is not necessarily indicative of future stock price performance.

Table of Contents

Company / Index	Base Period 12/31/2013	3/31/2014	6/30/2014	9/30/2014	12/31/2014
Intrexon Corporation	$ 100.00	$ 110.46	$ 105.59	$ 78.07	$ 115.67
S&P 500 Index	100.00	101.81	107.14	108.34	113.69
NYSE MKT ARCA Biotechnology Index	100.00	111.02	119.23	132.91	147.91
NASDAQ Biotechnology Index	100.00	104.25	113.51	120.87	134.40

Company / Index	3/31/2015	6/30/2015	9/30/2015	12/31/2015	3/31/2016	6/30/2016	9/30/2016	12/31/2016
Intrexon Corporation	$ 190.63	$ 205.75	$ 134.07	$ 127.12	$ 142.88	$ 103.76	$ 118.14	$ 102.45
S&P 500 Index	114.77	115.09	107.68	115.26	116.82	119.68	124.29	129.05
NYSE MKT ARCA Biotechnology Index	171.66	180.28	147.67	164.76	127.90	130.85	145.91	134.07
NASDAQ Biotechnology Index	152.23	163.69	134.34	150.22	115.85	114.54	128.86	118.15

Company / Index	3/31/2017	6/30/2017	9/30/2017	12/31/2017	3/31/2018	6/30/2018	9/30/2018	12/31/2018
Intrexon Corporation	$ 84.42	$ 102.60	$ 80.97	$ 49.07	$ 65.29	$ 59.37	$ 73.34	$ 27.85
S&P 500 Index	136.88	141.11	147.44	157.24	156.04	161.40	173.85	150.34
NYSE MKT ARCA Biotechnology Index	155.55	168.50	183.62	184.59	197.02	208.05	235.73	185.08
NASDAQ Biotechnology Index	130.95	138.67	149.41	143.74	143.83	148.26	164.86	131.00

Table of Contents

Recent Sales of Unregistered Securities and Use of Proceeds from Registered Securities

(a) Sales of Unregistered Securities

From January 1, 2018 through December 31, 2018, we issued 696,033 unregistered shares of our common stock as payment under the services agreement entered into and effective as of November 1, 2015, as amended, by and between us and Third Security as previously discussed in our Current Report on Form 8-K filed on January 2, 2018. We issued the above referenced shares of common stock in reliance on exemptions from registration under Section 4(a)(2) of the Securities Act.

(b) Use of Proceeds

None.

(c) Issuer Purchases of Equity Securities

None.

Item 6. Selected Financial Data

The following tables set forth our selected consolidated financial data for the periods and as of the dates indicated. You should read the following selected consolidated financial data in conjunction with our audited consolidated financial statements and the related notes thereto included elsewhere in this Annual Report and the "Management's Discussion and Analysis of Financial Condition and Results of Operations" section of this Annual Report.

The selected consolidated financial data set forth below as of December 31, 2018 and 2017, and for the years ended December 31, 2018, 2017 and 2016, are derived from our audited consolidated financial statements included elsewhere in this Annual Report. The selected consolidated financial data set forth below as of December 31, 2016, 2015, and 2014, and for the years ended December 31, 2015 and 2014, are derived from our audited consolidated financial statements contained in reports previously filed with the SEC, not included herein. Our audited consolidated financial statements have been prepared in United States dollars in accordance with U.S. GAAP.

Our historical results for any prior period are not necessarily indicative of results to be expected in any future period.

	Year Ended December 31,				
	2018	2017 (5)	2016	2015 (6)	2014 (7)
	(In thousands, except share and per share amounts)				
Statements of Operations Data:					
Collaboration and licensing revenues	$76,869	$145,579	$109,871	$87,821	$45,212
Product revenues	28,528	33,589	36,958	41,879	11,481
Service revenues	52,419	50,611	43,049	42,923	14,761
Total revenues (1)	160,574	230,981	190,926	173,605	71,930
Total operating expenses	666,184	368,871	316,092	320,469	141,892
Operating loss	(505,610)	(137,890)	(125,166)	(146,864)	(69,962)
Net loss	(514,706)	(126,820)	(190,274)	(87,994)	(85,616)
Net loss attributable to noncontrolling interests	5,370	9,802	3,662	3,501	3,794
Net loss attributable to Intrexon	(509,336)	(117,018)	(186,612)	(84,493)	(81,822)
Net loss attributable to common shareholders	(509,336)	(117,018)	(186,612)	(84,493)	(81,822)
Net loss attributable to common shareholders per share, basic and diluted	$(3.93)	$(0.98)	$(1.58)	$(0.76)	$(0.83)
Weighted average shares outstanding, basic and diluted	129,521,731	119,998,826	117,983,836	111,066,352	99,170,653

Table of Contents

	December 31,				
	2018	2017 (5)	2016	2015 (6)	2014 (7)
	(In thousands)				
Balance Sheet Data:					
Cash and cash equivalents	$102,768	$68,111	$62,607	$135,782	$27,466
Short-term and long-term investments	119,688	6,273	180,595	207,975	115,608
Investments in preferred stock (2)	191	161,225	129,545	—	—
Total assets	716,177	846,851	949,068	982,046	576,272
Deferred revenue, current and non-current (1)	69,764	236,397	310,142	197,729	113,209
Long-term debt (3)	211,794	8,037	7,948	8,528	10,369
Other liabilities (4)	55,897	55,872	61,730	70,903	43,405
Total Intrexon shareholders' equity	362,855	533,631	560,237	694,078	384,761
Noncontrolling interests	15,867	12,914	9,011	10,808	24,528
Total equity	378,722	546,545	569,248	704,886	409,289

(1) Revenues and deferred revenue in 2018 are accounted for under ASC 606, and revenues and deferred revenue prior to 2018 are accounted for under ASC 605, Revenue Recognition, or ASC 605. We adopted ASC 606 on January 1, 2018 using the modified retrospective method, which applies the changes in accounting prospectively and does not restate prior periods.

(2) In conjunction with the ZIOPHARM License Agreement in 2018, all of our ZIOPHARM preferred shares were returned to ZIOPHARM.

(3) In 2018, we completed a registered underwritten public offering of $200,000 aggregate principal amount of Convertible Notes.

(4) Other liabilities include $8,801, $15,629, and $20,485 of deferred consideration as of December 31, 2016, 2015, and 2014, respectively.

(5) In 2017, we acquired GenVec, Inc., or GenVec, and began including the results of its operations effective on the acquisition date. In 2017, we also acquired the remaining 49 percent of outstanding equity of Biological & Popular Culture, Inc.

(6) In 2015, we acquired ActoGeniX NV, Okanagan, and Oxitec and began including the results of their operations effective on the respective acquisition dates.

(7) In 2014, we acquired Medistem, Inc. and Trans Ova and began including the results of their operations effective on the respective acquisition dates.

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

The following discussion and analysis of financial condition and results of operations is provided to enhance the understanding of, and should be read in conjunction with, Part I, Item 1, "Business" and Item 8, "Financial Statements and Supplementary Data." For information on risks and uncertainties related to our business that may make past performance not indicative of future results, or cause actual results to differ materially from any forward-looking statements, see "Special Note Regarding Forward-Looking Statements," and Part I, Item 1A, "Risk Factors."

Financial overview

We have incurred significant losses since our inception. We anticipate that we may continue to incur significant losses for the foreseeable future, and we may never achieve or maintain profitability. Outside of collaboration and license fee payments and sales of products and services, which vary over time, we have not generated significant revenues, including revenues or royalties from product sales by us or our collaborators. Certain of our consolidated subsidiaries require regulatory approval and/or commercial scale-up before they may commence significant product sales and operating profits.

Table of Contents

Sources of revenue

Historically, we have derived our collaboration and licensing revenues through agreements with counterparties for the development and commercialization of products enabled by our technologies. Generally, the terms of these collaborations provide that we receive some or all of the following: (i) technology access fees upon signing; (ii) reimbursements of costs incurred by us for our research and development and/or manufacturing efforts related to specific applications provided for in the collaboration; (iii) milestone payments upon the achievement of specified development, regulatory and commercial activities; and (iv) royalties on sales of products arising from the collaboration.

Our technology access fees and milestone payments may be in the form of cash or securities of the collaborator. Our collaborations contain multiple arrangements, and we typically defer revenues from the technology access fees and milestone payments received and recognize such revenues in the future over the anticipated performance period. We are also entitled to sublicensing revenues in those situations where our collaborators choose to license our technologies to other parties.

From time to time, we and certain collaborators may cancel the agreements or we may repurchase rights to the exclusive fields from collaborators, relieving us of any further performance obligations under the agreement. Upon such circumstances or when we determine no further performance obligations are required of us under an agreement, we may recognize any remaining deferred revenue as either collaboration revenue or as a reduction of in-process research and development expense, depending on the circumstances.

We generate product and service revenues primarily through sales of products or services that are created from technologies developed or owned by us. Our primary current offerings include sales of advanced reproductive technologies, including our bovine embryo transfer and in vitro fertilization processes and from genetic preservation and sexed semen processes and applications of such processes to other livestock, as well as sales of livestock and embryos produced using these processes and used in production. We recognize revenue when control of the promised product is transferred to the customer or when the promised service is completed.

In future periods, our revenues will depend in part on our ability to partner our more mature programs and capabilities, the number of collaborations to which we are party, the advancement and creation of our programs and programs within our collaborations and the extent to which we or our collaborators bring products enabled by our technologies to market. We expect our collaboration revenues will decrease considerably as a result of our reacquisition of rights to fields previously licensed to collaborators, after which we no longer expect to receive reimbursement of costs incurred by us for research and development services and will no longer recognize previously deferred revenues associated with the terminated collaboration. Our revenues will also depend upon our ability to maintain or improve the volume and pricing of our current product and service offerings and to develop and scale up production of new offerings from the various technologies of our subsidiaries. Our future revenues may also include additional revenue streams we may acquire through mergers and acquisitions. In light of our limited operating history and experience, there can be no assurance as to the timing, magnitude and predictability of revenues to which we might be entitled.

Cost of products and services

Cost of products and services includes primarily labor and related costs, drugs and supplies used primarily in the embryo transfer and in vitro fertilization processes, livestock and feed used in production, and facility charges, including rent and depreciation. Fluctuations in the price of livestock and feed have not had a significant impact on our operating margins and no derivative financial instruments are used to mitigate the price risk.

Research and development expenses

We recognize research and development expenses as they are incurred. Our research and development expenses consist primarily of:

- salaries and benefits, including stock-based compensation expense, for personnel in research and development functions;
- fees paid to consultants and contract research organizations who perform research on our behalf and under our direction;
- costs related to laboratory supplies used in our research and development efforts;

59

Table of Contents

- costs related to certain in-licensed technology rights or reacquired in-process research and development;
- depreciation of leasehold improvements and laboratory equipment;
- amortization of patents and related technologies acquired in mergers and acquisitions; and
- rent and utility costs for our research and development facilities.

We have no individually significant research and development projects, and our research and development expenses primarily relate to either the costs incurred to expand or otherwise improve our multiple platform technologies, the costs incurred to develop a specific application of our technologies in support of current or prospective partners, or costs incurred to expand or otherwise improve our products and services. Research and development expenses, including costs for preclinical and clinical development, incurred for programs we support pursuant to an ECC agreement are typically reimbursed by the partner at cost, and all other research and development programs may be terminated or otherwise deferred at our discretion. The amount of our research and development expenses may be impacted by, among other things, the number of ECCs and the number and size of programs we may support on behalf of an ECC.

The table below summarizes our research and development expenses incurred to expand or otherwise improve our multiple platform technologies, the costs incurred to develop a specific application of our technologies in support of current or prospective partners, or costs incurred to expand or otherwise improve our products and services for the years ended December 31, 2018, 2017, and 2016. Other research and development expenses for these periods include indirect salaries and overhead expenses that are not allocated to either expanding or improving our multiple platform technologies, specific applications of our technologies in support of current or prospective partners, or expanding or improving our product and services offerings. Additionally, other research and development expenses for the year ended December 31, 2018 include $236.7 million of expense related to in-process research and development reacquired from several collaborators in 2018.

	Year Ended December 31,		
	2018	2017	2016
	(In thousands)		
Expansion or improvement of our platform technologies	$19,788	$14,515	$12,195
Specific applications of our technologies in support of current and prospective partners	74,169	77,001	62,960
Expansion or improvement of our product and service offerings	27,331	27,134	17,585
Other	283,298	24,557	19,395
Total research and development expenses	$404,586	$143,207	$112,135

Other than our expenses related to reacquired in-process research and development, we expect that our research and development expenses will increase as we develop our own proprietary programs and expand our offerings. We believe these increases will likely include increased costs related to the hiring of additional personnel in research and development functions, increased costs paid to consultants and contract research organizations, and increased costs related to laboratory supplies. Research and development expenses may also increase as a result of ongoing research and development operations that we might assume through mergers and acquisitions.

Selling, general and administrative expenses

Selling, general and administrative, or SG&A, expenses consist primarily of salaries and related costs, including stock-based compensation expense, for employees in executive, operational, finance, sales and marketing, information technology, legal and corporate communications functions. Other significant SG&A expenses include rent and utilities, insurance, accounting and legal services, and expenses associated with obtaining and maintaining our intellectual property.

SG&A expenses may increase in the future to support our expanding operations as we explore new partnering opportunities and continue to develop our proprietary programs. These increases would likely include costs related to the hiring of additional personnel and increased fees for business development functions, costs associated with defending us in litigation matters, the costs of outside consultants, and other professional services. SG&A expenses may also increase as a result of ongoing operations that we might assume through mergers and acquisitions.

Table of Contents

Other income (expense), net

We hold equity securities and preferred stock received and/or purchased from certain collaborators. Other than investments accounted for using the equity method discussed below, we elected the fair value option to account for our equity securities and preferred stock held in these collaborators. These equity securities and preferred stock are recorded at fair value at each reporting date. Unrealized appreciation (depreciation) resulting from fair value adjustments are reported as other income (expense) in the consolidated statements of operations. As such, we bear the risk that fluctuations in the securities' share prices may significantly impact our results of operations.

Interest expense is expected to increase in future periods as we incur interest expense related to the Convertible Notes issued in July 2018.

Interest income consists of interest earned on our cash and cash equivalents and short-term and long-term investments.

Dividend income consists of the monthly preferred stock dividends received from our investments in preferred stock. Dividend income is expected to decrease in future periods because we returned our ZIOPHARM preferred shares to ZIOPHARM in October 2018.

Equity in net income (loss) of affiliates

Equity in net income or loss of affiliates is our pro-rata share of our equity method investments' operating results, adjusted for accretion of basis difference. We account for investments in our JVs and start-up entities backed by Harvest Intrexon Enterprise Fund I, LP, or Harvest, using the equity method of accounting since we have the ability to exercise significant influence, but not control, over the operating activities of these entities.

Table of Contents

Results of operations

Comparison of the year ended December 31, 2018 to the year ended December 31, 2017

The following table summarizes our results of operations for the years ended December 31, 2018 and 2017, together with the changes in those items in dollars and as a percentage:

	Year Ended December 31,		Dollar Change	Percent Change
	2018	2017		
	(In thousands)			
Revenues (1)				
Collaboration and licensing revenues (2)	$76,869	$145,579	$(68,710)	(47.2)%
Product revenues	28,528	33,589	(5,061)	(15.1)%
Service revenues	52,419	50,611	1,808	3.6 %
Other revenues	2,758	1,202	1,556	129.5 %
Total revenues	160,574	230,981	(70,407)	(30.5)%
Operating expenses				
Cost of products	35,698	33,263	2,435	7.3 %
Cost of services	27,589	29,525	(1,936)	(6.6)%
Research and development	404,586	143,207	261,379	182.5 %
Selling, general and administrative	137,807	146,103	(8,296)	(5.7)%
Impairment loss	60,504	16,773	43,731	>200%
Total operating expenses	666,184	368,871	297,313	80.6 %
Operating loss	(505,610)	(137,890)	(367,720)	>200%
Total other income (expense), net	(19,016)	22,473	(41,489)	(184.6)%
Equity in loss of affiliates	(11,608)	(14,283)	2,675	(18.7)%
Loss before income taxes	(536,234)	(129,700)	(406,534)	>200%
Income tax benefit	21,528	2,880	18,648	>200%
Net loss	(514,706)	(126,820)	(387,886)	>200%
Net loss attributable to noncontrolling interests	5,370	9,802	(4,432)	(45.2)%
Net loss attributable to Intrexon	$(509,336)	$(117,018)	$(392,318)	>200%

(1) Revenues in 2018 are accounted for under ASC 606 and revenues in 2017 are accounted for under ASC 605. We adopted ASC 606 on January 1, 2018 using the modified retrospective method, which applies the changes in accounting prospectively and does not restate prior periods.

(2) Including $60,238 and $130,670 from related parties for the years ended December 31, 2018 and 2017, respectively.

Table of Contents

Collaboration and licensing revenues

The following table shows the collaboration and licensing revenue recognized for the years ended December 31, 2018 and 2017, together with the changes in those items.

	Year Ended December 31,		Dollar Change
	2018	2017	
	(In thousands)		
ZIOPHARM Oncology, Inc.	$16,298	$69,812	$(53,514)
Ares Trading S.A.	11,175	10,738	437
Oragenics, Inc.	1,353	2,020	(667)
Intrexon T1D Partners, LLC	2,502	5,968	(3,466)
Intrexon Energy Partners, LLC	6,929	10,665	(3,736)
Intrexon Energy Partners II, LLC	2,998	3,672	(674)
Genopaver, LLC	3,710	6,690	(2,980)
Fibrocell Science, Inc.	1,394	7,344	(5,950)
Persea Bio, LLC	955	946	9
OvaXon, LLC	—	1,966	(1,966)
S & I Ophthalmic, LLC	—	755	(755)
Harvest start-up entities (1)	14,447	15,232	(785)
Other	15,108	9,771	5,337
Total	$76,869	$145,579	$(68,710)

(1) For the years ended December 31, 2018 and 2017, revenue recognized from collaborations with Harvest start-up entities include Genten Therapeutics, Inc.; CRS Bio, Inc.; Exotech Bio, Inc.; AD Skincare, Inc.; and Thrive Agrobiotics, Inc. For the year ended December 31, 2017, revenues recognized from collaborations with Harvest start-up entities also include Relieve Genetics, Inc.

Collaboration and licensing revenues decreased $68.7 million, or 47 percent, from the year ended December 31, 2017 due to (i) the mutual termination in 2017 of our second ECC with ZIOPHARM for the treatment of graft-versus-host disease, (ii) a decrease in research and development services for certain of our ECCs as we redeployed certain resources towards supporting prospective new platforms and partnering opportunities and began to focus more on the further development of relationships and structures that provide us with more control and ownership over the development process and commercialization path, including programs where we reacquired the previously licensed technology rights in 2018, and (iii) a decrease in research and development services we perform for collaborators upon the transition of program execution to our collaborators.

Product revenues and gross margin

Product revenue decreased $5.1 million, or 15 percent, from the year ended December 31, 2017. The decrease in product revenues was primarily due to lower milk prices which in turn resulted in lower customer demand for live calves, cows previously used in production, and cloned products. Gross margin on products declined in the current period as a result of the lower product sales and increased operating costs associated with new product offerings and cloned products.

Service revenues and gross margin

Service revenue increased $1.8 million, or 4 percent, over the year ended December 31, 2017. The increase in service revenues and gross margin thereon relates to pricing changes and an increase in the number of embryos produced per bovine in vitro fertilization cycle performed due to improved production results.

Table of Contents

Research and development expenses

Research and development expenses increased $261.4 million, or 183 percent, over the year ended December 31, 2017. Current period research and development expenses include $236.7 million of expenses related to in-process research and development reacquired from former collaborators.

Selling, general and administrative expenses

SG&A expenses decreased $8.3 million, or 6 percent, from the year ended December 31, 2017. Legal and professional fees decreased $7.5 million primarily due to (i) decreased legal fees associated with ongoing litigation and (ii) decreased fees incurred for regulatory and other consultants.

Impairment loss

Impairment loss for the year ended December 31, 2018 of $60.5 million arose from a charge taken due to a change in our business strategy for commercializing the Oxitec technology targeting the Aedes Aegypti mosquito. Impairment loss for the year ended December 31, 2017 of $16.8 million resulted from our annual test for goodwill and indefinite-lived intangible asset impairment in the fourth quarter. Based on the price per share received by AquaBounty in its then-recent underwritten public offering, we determined that it was more likely than not that the fair value of our AquaBounty reporting unit was less than the carrying value and recorded a $13.0 million impairment charge representing the estimated excess of carrying value over fair value of this reporting unit. Additionally, in the fourth quarter of 2017, we decided to forgo further development of certain of our in-process research and development assets and as a result recorded a $3.0 million impairment charge.

Total other income (expense), net

Total other income (expense), net, decreased $41.5 million, or 185 percent, from the year ended December 31, 2017. This decrease was primarily attributable to losses on our investment in ZIOPHARM preferred stock prior to returning this investment to ZIOPHARM in October 2018, as well as an increase in interest expense related to the Convertible Notes issued in July 2018.

Table of Contents

Comparison of the year ended December 31, 2017 to the year ended December 31, 2016

The following table summarizes our results of operations for the years ended December 31, 2017 and 2016, together with the changes in those items in dollars and as a percentage:

	Year Ended December 31,		Dollar Change	Percent Change
	2017	2016		
	(In thousands)			
Revenues				
Collaboration and licensing revenues (1)	$145,579	$109,871	$35,708	32.5 %
Product revenues	33,589	36,958	(3,369)	(9.1)%
Service revenues	50,611	43,049	7,562	17.6 %
Other revenues	1,202	1,048	154	14.7 %
Total revenues	230,981	190,926	40,055	21.0 %
Operating expenses				
Cost of products	33,263	37,709	(4,446)	(11.8)%
Cost of services	29,525	23,930	5,595	23.4 %
Research and development	143,207	112,135	31,072	27.7 %
Selling, general and administrative	146,103	142,318	3,785	2.7 %
Impairment loss	16,773	—	16,773	N/A
Total operating expenses	368,871	316,092	52,779	16.7 %
Operating loss	(137,890)	(125,166)	(12,724)	10.2 %
Total other income (expense), net	22,473	(47,865)	70,338	147.0 %
Equity in loss of affiliates	(14,283)	(21,120)	6,837	(32.4)%
Loss before income taxes	(129,700)	(194,151)	64,451	(33.2)%
Income tax benefit	2,880	3,877	(997)	(25.7)%
Net loss	(126,820)	(190,274)	63,454	(33.3)%
Net loss attributable to noncontrolling interests	9,802	3,662	6,140	167.7 %
Net loss attributable to Intrexon	$(117,018)	$(186,612)	$69,594	(37.3)%

(1) Including $130,670 and $93,792 from related parties for the years ended December 31, 2017 and 2016, respectively.

Table of Contents

Collaboration and licensing revenues

The following table shows the collaboration and licensing revenue recognized for the years ended December 31, 2017 and 2016, together with the changes in those items.

	Year Ended December 31,		Dollar Change
	2017	2016	
	(In thousands)		
ZIOPHARM Oncology, Inc.	$69,812	$33,836	$35,976
Ares Trading S.A.	10,738	10,192	546
Oragenics, Inc.	2,020	2,752	(732)
Intrexon T1D Partners, LLC	5,968	1,908	4,060
Intrexon Energy Partners, LLC	10,665	17,552	(6,887)
Intrexon Energy Partners II, LLC	3,672	3,169	503
Genopaver, LLC	6,690	6,117	573
Fibrocell Science, Inc.	7,344	5,942	1,402
Persea Bio, LLC	946	1,278	(332)
OvaXon, LLC	1,966	2,934	(968)
S & I Ophthalmic, LLC	755	6,141	(5,386)
Harvest start-up entities (1)	15,232	4,974	10,258
Other	9,771	13,076	(3,305)
Total	$145,579	$109,871	$35,708

(1) For the years ended December 31, 2017 and 2016, revenue recognized from collaborations with Harvest start-up entities include Genten Therapeutics, Inc.; CRS Bio, Inc.; Relieve Genetics, Inc.; Exotech Bio, Inc.; AD Skincare, Inc.; and Thrive Agrobiotics, Inc.

Collaboration and licensing revenues increased $35.7 million, or 33 percent, over the year ended December 31, 2016 due primarily to (i) the recognition of previously deferred revenue totaling $28.9 million related to our second ECC with ZIOPHARM for the treatment of graft-versus-host disease, which was mutually terminated in December 2017 and (ii) a full year of recognition of deferred revenue associated with the payment received in June 2016 from ZIOPHARM to amend our collaborations.

Product revenues and gross margin

Product revenue decreased $3.4 million, or 9 percent, from the year ended December 31, 2016. The decrease in product revenues was primarily due to lower milk prices which in turn resulted in lower customer demand for cows and live calves. Gross margin on products improved slightly in the current period primarily due to a decline in the average cost of cows.

Service revenues and gross margin

Service revenue increased $7.6 million, or 18 percent, over the year ended December 31, 2016. The increase in service revenues relates to an increase in the number of bovine in vitro fertilization cycles performed due to higher customer demand. Gross margin on services decreased slightly in the current period primarily due to an increase in royalties and commissions due to vendors.

Research and development expenses

Research and development expenses increased $31.1 million, or 28 percent, over the year ended December 31, 2016. The increase is due primarily to increases in (i) lab supplies and consulting expenses; (ii) salaries, benefits and other personnel costs for research and development employees; (iii) depreciation and amortization; and (iv) rent and utilities expenses. Lab supplies and consulting expenses increased $11.3 million due to (i) the progression of certain programs into the preclinical and clinical phases with certain of our collaborators and (ii) the expansion or improvement of certain of our platform technologies. Salaries,

Table of Contents

benefits and other personnel costs increased $8.0 million due to an increase in research and development headcount necessary to invest in current or expanding platforms and to develop new prospective collaborations and other partnering opportunities. Depreciation and amortization increased $5.8 million primarily as a result of (i) the amortization of developed technology acquired from Oxitec, which began in November 2016 upon the completion of certain operational and regulatory events, and (ii) the amortization of developed technology acquired from GenVec in June 2017. Rent and utilities expenses increased $3.3 million due to the expansion of certain facilities to support our increased headcount.

Selling, general and administrative expenses

SG&A expenses increased $3.8 million, or 3 percent, over the year ended December 31, 2016. Salaries, benefits and other personnel costs increased $4.2 million primarily due to increased headcount to support our expanding operations. Legal and professional fees increased $4.2 million primarily due to (i) increased legal fees to defend ongoing litigation and to support our evolving corporate strategy and (ii) consulting fees related to potential business opportunities and public relations. These increases were partially offset by $4.3 million in litigation expenses recorded in 2016 arising from the entrance of a court order in our trial with XY.

Impairment loss

Impairment loss for the year ended December 31, 2017 of $16.8 million resulted from our annual test for goodwill and indefinite-lived intangible asset impairment in the fourth quarter. Based on the price per share received by AquaBounty in its recent underwritten public offering, we determined that it was more likely than not that the fair value of our AquaBounty reporting unit was less than the carrying value and recorded a $13.0 million impairment charge representing the estimated excess of carrying value over fair value of this reporting unit. Additionally, in the fourth quarter of 2017, we decided to forgo further development of certain of our in-process research and development assets and as a result recorded a $3.0 million impairment charge.

Total other income (expense), net

Total other income (expense), net, increased $70.3 million, or 147 percent, over the year ended December 31, 2016. This increase was primarily attributable to (i) the change in fair market value of our equity securities portfolio, investments in preferred stock, and other convertible instruments and (ii) a full year of dividend income from our investment in preferred stock of ZIOPHARM.

Equity in net loss of affiliates

Equity in net loss of affiliates for the years ended December 31, 2017 and 2016 includes our pro-rata share of the net losses of our investments we account for using the equity method of accounting. The $6.8 million, or 32 percent, decrease was primarily due to the temporary redeployment of certain resources away from JV programs towards supporting prospective new platforms and additional collaborations.

Liquidity and capital resources

Sources of liquidity

We have incurred losses from operations since our inception and as of December 31, 2018, we had an accumulated deficit of $1.3 billion. From our inception through December 31, 2018, we have funded our operations principally with proceeds received from private and public equity and debt offerings, cash received from our collaborators and through product and service sales made directly to customers. As of December 31, 2018, we had cash and cash equivalents of $102.8 million and short-term investments of $119.7 million. Cash in excess of immediate requirements is typically invested primarily in money market funds and United States government debt securities in order to maintain liquidity and preserve capital.

We currently generate cash receipts primarily from sales of products and services, reimbursement of research and development services performed by us and from strategic transactions involving our subsidiaries.

Table of Contents

Cash flows

The following table sets forth the significant sources and uses of cash for the periods set forth below:

	Year Ended December 31,		
	2018	2017	2016
	(In thousands)		
Net cash provided by (used in):			
Operating activities	$(124,240)	$(103,720)	$(48,988)
Investing activities	(151,213)	104,332	(28,392)
Financing activities	309,795	4,284	12,065
Effect of exchange rate changes on cash, cash equivalents, and restricted cash	295	1,055	(873)
Net increase (decrease) in cash, cash equivalents, and restricted cash	$34,637	$5,951	$(66,188)

Cash flows from operating activities:

In 2018, our net loss was $514.7 million, which includes the following significant noncash expenses totaling $440.0 million: (i) $236.7 million of expense related to reacquired in-process research and development previously licensed to certain of our collaborators, (ii) $60.5 million of impairment loss, (iii) $36.3 million of stock-based compensation expense, (iv) $33.1 million of depreciation and amortization expense, (v) $30.2 million of net unrealized and realized losses on our equity securities and preferred stock, (vi) $20.9 million of loss on disposal of assets, (vii) $11.6 million of equity in net loss of affiliates, and (viii) $10.7 million of shares issued as payment for services. These expenses were partially offset by (i) $21.3 million of net changes in deferred income taxes and (ii) $14.8 million of noncash dividend income. Additionally, we had a $20.0 million net increase in our operating assets and liabilities primarily as a result of the recognition of previously deferred revenue.

In 2017, our net loss was $126.8 million, which includes the following significant noncash expenses totaling $114.9 million: (i) $41.6 million of stock-based compensation expense, (ii) $31.1 million of depreciation and amortization expense, (iii) $16.8 million of impairment losses, (iv) $14.3 million of equity in net loss of affiliates, and (v) $11.1 million of shares issued as payment for services. These expenses were partially offset by $16.8 million of noncash dividend income. Additionally, we had a $74.6 million net increase in our operating assets and liabilities.

In 2016, our net loss was $190.3 million, which includes the following significant noncash expenses totaling $157.6 million: (i) $58.9 million of net unrealized and realized losses on our equity securities and preferred stock, (ii) $42.2 million of stock-based compensation expense, (iii) $24.6 million of depreciation and amortization expense, (iv) $21.1 million of equity in net loss of affiliates, and (v) $10.8 million of shares issued as payment for services. These expenses were partially offset by $7.4 million of noncash dividend income. Additionally, we had a $17.7 million net increase in our operating assets and liabilities primarily as a result of the recognition of previously deferred revenue, partially offset by a $10.0 million technology access fee received in cash pursuant to a new collaboration.

Cash flows from investing activities:

During 2018, we used $112.7 million for purchases of short-term investments, net of maturities; $41.6 million for purchases of property, plant and equipment; and $16.6 million for investments in our JVs, and we received $15.5 million in an asset acquisition.

During 2017, we received proceeds of $174.5 million from the maturity of short-term investments, and we used $46.7 million for purchases of property, plant and equipment; $14.2 million for the purchase of a land-based aquaculture facility by AquaBounty; and $11.2 million for investments in our JVs.

During 2016, we used $31.6 million for purchases of property, plant and equipment; $11.5 million for investments in our JVs; $7.2 million to acquire the assets of Old EnviroFlight; $3.0 million for the issuances of notes receivable; and $2.3 million for purchases of equity securities and warrants of certain of our collaborators, and we received $26.7 million of proceeds from the maturity of short-term investments, net of purchases.

Table of Contents

Cash flows from financing activities:

During 2018, we received $219.9 million net proceeds from the issuance of long-term debt and $88.0 million net proceeds from public financings.

During 2017, we received $13.7 million proceeds from a private placement of our common stock with an affiliate of Third Security and paid $8.7 million of deferred consideration to former shareholders of acquired businesses.

During 2016, we received $19.2 million from stock option exercises and paid $6.7 million of deferred consideration to former shareholders of an acquired business.

Future capital requirements

Our future capital requirements will depend on many factors, including:

- progress in our research and development programs, as well as the magnitude of these programs;
- the timing, receipt and amount of any payments received in connection with strategic transactions;
- the timing, receipt and amount of upfront, milestone and other payments, if any, from present and future collaborators, if any;
- the timing, receipt and amount of sales and royalties, if any, from our potential products;
- our ability to maintain or improve the volume and pricing of our current product and service offerings and to develop new offerings, including those that may incorporate new technologies;
- costs we might incur to reacquire previously licensed rights for our own development;
- the timing and capital requirements to scale up our various product and service offerings and customer acceptance thereof;
- our ability to maintain and establish additional collaborative arrangements and/or new strategic initiatives;
- the timing of regulatory approval of products of our collaborations and operations;
- the resources, time and cost required for the preparation, filing, prosecution, maintenance and enforcement of patent claims;
- investments we may make in current and future collaborators, including JVs;
- strategic mergers and acquisitions, including both the upfront acquisition cost as well as the cost to integrate, maintain, and expand the strategic target; and
- the costs associated with legal activities, including litigation, arising in the course of our business activities and our ability to prevail in any such legal disputes.

Until such time, if ever, as we can regularly generate positive operating cash flows, we may finance our cash needs through a combination of equity offerings, debt financings, government or other third-party funding, strategic alliances and licensing arrangements. To the extent that we raise additional capital through the sale of equity or convertible debt securities, the ownership interests of our common shareholders will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect the rights of our common shareholders. Debt financing, if available, may involve agreements that include covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends. If we raise additional funds through strategic transactions, collaborations, or licensing arrangements with third parties, we may have to relinquish valuable rights to our technologies, future revenue streams, research programs or product candidates or to grant licenses on terms that may not be favorable to us.

Our consolidated financial statements as of and for the year ended December 31, 2018 have been prepared on the basis that we will continue as a going concern, which contemplates the realization of assets and satisfaction of liabilities in the normal course

Table of Contents

of business. Based on our balance of cash, cash equivalents and short-term investments of $222.5 million at December 31, 2018 and recurring losses since inception, there is substantial doubt about our ability to continue as a going concern within one year after the date that our financial statements were issued. Our ability to continue as a going concern will depend on whether we are able to generate positive cash flows through equity or debt financings, strategic collaborations or equity investments in our subsidiaries or platforms, and the continuation of cash revenues from collaborators and customers of our products and services. The consolidated financial statements do not include any adjustments that might result from the outcome of this uncertainty, which could have a material adverse effect on our financial condition. In addition, if we are unable to continue as a going concern, we may be unable to meet our obligations under our existing debt facilities, which could result in an acceleration of our obligation to repay all amounts outstanding under those facilities, and we may be forced to liquidate our assets. In such a scenario, the values we receive for our assets in liquidation or dissolution could be significantly lower than the values reflected in our consolidated financial statements.

If we do not achieve our planned operating results, our ability to continue as a going concern would be jeopardized and we may need to take the following actions to support our liquidity needs in 2019:

- shift our internal investments from subsidiaries and platforms whose potential for value creation is longer-term to near-term opportunities;
- sell certain of our operating subsidiaries to third parties;
- reduce operating expenditures for third-party contractors, including consultants, professional advisors, and other vendors; and
- reduce or delay capital expenditures, including non-essential facility expansions, lab equipment, and information technology projects.

Implementing this plan could have a negative impact on our ability to continue our business as currently contemplated, including, without limitation, delays or failures in our ability to:

- maintain the diversity of our various portfolio offerings;
- develop and commercialize products within planned timelines or at planned scales; and
- invest in new research and development efforts.

Contractual obligations and commitments

The following table summarizes our significant contractual obligations and commitments as of December 31, 2018 and the effects such obligations are expected to have on our liquidity and cash flows in future periods:

	Total	Less Than 1 Year	1-3 Years	3-5 Years	More Than 5 Years
	(In thousands)				
Operating leases	$77,910	$ 9,182	$19,037	$15,534	$34,157
Purchase commitments	20,055	9,210	10,845	—	—
Convertible debt (1)	255,290	—	55,290	200,000	—
Cash interest payable on convertible debt	31,500	7,000	14,000	10,500	—
Long-term debt, excluding convertible debt	6,318	559	958	1,862	2,939
Contingent consideration	585	—	585	—	—
Total	$391,658	$ 25,951	$100,715	$227,896	$37,096

(1) The convertible debt may be converted to Intrexon common stock or to the common stock of one of our subsidiaries.

In addition to the obligations in the table above, as of December 31, 2018 we also have the following significant contractual obligations described below.

Table of Contents

In conjunction with the formation of our JVs, we committed to making future capital contributions subject to certain conditions and limitations. As of December 31, 2018, our remaining capital contribution commitments to our JVs were $14.9 million. These future capital contributions are not included in the table above due to the uncertainty of the timing and amounts of such contributions.

We are party to in-licensed research and development agreements with various academic and commercial institutions where we could be required to make future payments for annual maintenance fees as well as for milestones and royalties we might receive upon commercial sales of products that incorporate their technologies. These agreements are generally subject to termination by us and therefore no amounts are included in the tables above. As of December 31, 2018, we also had research and development commitments with third parties totaling $11.9 million that had not yet been incurred.

In January 2009, AquaBounty was awarded a grant to provide funding of a research and development project from the Atlantic Canada Opportunities Agency, a Canadian government agency. Amounts claimed by AquaBounty must be repaid in the form of a 10 percent royalty on any products commercialized out of this research and development project until fully paid. Because the timing of commercialization is subject to additional regulatory considerations, the timing of repayment is uncertain. AquaBounty claimed all amounts available under the grant, resulting in total long-term debt of $2.1 million on our consolidated balance sheet as of December 31, 2018. This amount is not included in the table above due to the uncertainty of the timing of repayment.

Net operating losses

As of December 31, 2018, we had net operating loss carryforwards of approximately $369.1 million for United States federal income tax purposes available to offset future taxable income, including $116.6 million generated after 2017, and United States federal and state research and development tax credits of approximately $7.9 million, prior to consideration of annual limitations that may be imposed under Section 382. Carryforwards generated prior to 2018 begin to expire in 2022. Our direct foreign subsidiaries have foreign loss carryforwards of approximately $159.8 million, most of which do not expire. Excluding certain deferred tax liabilities totaling $7.2 million, our remaining net deferred tax assets, which primarily relate to these loss carryforwards, are offset by a valuation allowance due to our history of net losses.

As a result of our past issuances of stock, as well as due to prior mergers and acquisitions, certain of our net operating losses have been subject to limitations pursuant to Section 382. As of December 31, 2018, Intrexon has utilized all net operating losses subject to Section 382 limitations, other than those losses inherited via acquisitions. As of December 31, 2018, approximately $41.9 million of domestic net operating losses were inherited via acquisitions and are limited based on the value of the target at the time of the transaction. Future changes in stock ownership may also trigger an ownership change and, consequently, a Section 382 limitation.

We do not file a consolidated income tax return with AquaBounty. As of December 31, 2018, AquaBounty had loss carryforwards for federal and foreign income tax purposes of approximately $37.8 million, including $9.4 million generated after 2017, and $14.0 million, respectively, and foreign research tax credits of $2.6 million available to offset future taxable income, prior to consideration of annual limitations that may be imposed under Section 382 or analogous foreign provisions. Carryforwards generated prior to 2018 began to expire in 2018. As a result of our ownership in AquaBounty passing 50 percent in 2013, an annual Section 382 limitation of approximately $0.9 million per year will apply to losses and credits carried forward by AquaBounty from prior years, which are also subject to prior Section 382 limitations.

The Tax Act introduced certain limitations on utilization of net operating losses that are generated after 2017, generally limiting utilization of those losses to 80 percent of future annual taxable income. However, losses generated after 2017 will generally have an indefinite carryforward period.

Off-balance sheet arrangements

We did not have during the periods presented, and we do not currently have, any off-balance sheet arrangements, other than operating leases and purchase commitments as mentioned above, as defined under SEC rules. On January 1, 2019, we are adopting Accounting Standards Update 2016-02, Leases (Topic 842), or ASU 2016-02. Upon adoption of ASU 2016-02, we expect to recognize right-of-use assets and lease liabilities for operating leases within a range of $42.0 million to $47.0 million.

Critical accounting policies and estimates

Our management's discussion and analysis of our financial condition and results of operations is based on our consolidated financial statements, which we have prepared in accordance with U.S. GAAP. The preparation of these consolidated financial

Table of Contents

statements requires us to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the financial statements, as well as the reported revenues and expenses during the reporting periods. We evaluate these estimates and judgments on an ongoing basis. We base our estimates on historical experience and on various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not readily apparent from other sources. Our actual results may differ from these estimates under different assumptions or conditions.

While our significant accounting policies are more fully described in "Notes to the Consolidated Financial Statements - Note 2" appearing elsewhere in this Annual Report, we believe that the following accounting policies are the most critical for fully understanding and evaluating our financial condition and results of operations.

Revenue recognition (for the year ended December 31, 2018)

Effective January 1, 2018, we apply ASC 606. Under ASC 606, we recognize revenue when our customer obtains control of the promised goods or services, in an amount that reflects the consideration that we expect to receive in exchange for those goods or services. To determine revenue recognition for arrangements that are within the scope of ASC 606, we perform the following five steps: (i) identify the contract(s) with a customer, (ii) identify the promises and distinct performance obligations in the contract, (iii) determine the transaction price, (iv) allocate the transaction price to the performance obligations in the contract, and (v) recognize revenue when (or as) we satisfy the performance obligations.

Collaboration and licensing revenues

We generate collaboration and licensing revenues through the execution of agreements with collaborators, known as ECCs, and licensing agreements whereby the collaborators or the licensee obtain exclusive access to our proprietary technologies for use in the research, development and commercialization of products and/or treatments in a contractually specified field of use. Generally, the terms of these agreements provide that we receive some or all of the following: (i) upfront payments upon consummation of the agreement; (ii) reimbursements for costs incurred by us for research and development and/or manufacturing efforts related to specific applications provided for in the agreement; (iii) milestone payments upon the achievement of specified development, regulatory and commercial activities; and (iv) royalties on sales of products arising from the collaboration or licensing agreement. The agreement typically continues in perpetuity unless terminated and each of our collaborators retains a right to terminate the agreement upon providing us written notice a certain period of time prior to such termination, generally 90 days.

Our collaboration and licensing agreements typically contain multiple promises, including technology licenses, research and development services and in certain cases manufacturing services. We determine whether each of the promises is a distinct performance obligation. As the nature of the promises in our collaboration and licensing agreements are highly integrated and interrelated, we typically combine most of our promises into a single performance obligation. Because we are performing research and development services during early-stage development, the services are integral to the utilization of the technology license. Therefore, we have determined that the technology license and research and development services are typically inseparable from each other during the performance period of our collaboration and licensing agreements. Contingent manufacturing services that may be provided under certain of our agreements are considered to be a separate future contract and not part of the current collaboration or licensing agreement.

At contract inception, we determine the transaction price, including fixed consideration and any estimated amounts of variable consideration. The upfront payment received upon consummation of the agreement is fixed and nonrefundable. Variable consideration is subject to a constraint and amounts are included in the transaction price to the extent that it is probable that a significant reversal in the amount of cumulative revenue recognized will not occur when the uncertainty associated with the variable consideration is subsequently resolved. Variable consideration may include reimbursements for costs incurred by us for research and development efforts; milestone payments upon the achievement of certain development, regulatory and commercial activities; and royalties on sales of products arising from the collaboration or licensing agreement. We determine the initial transaction price and exclude variable consideration that is otherwise constrained pursuant to the guidance in ASC 606.

The transaction price is allocated to the performance obligations in the agreement based on the standalone selling price of each performance obligation. We typically group the promises in our collaboration and licensing agreements into one performance obligation so the entire transaction price relates to this single performance obligation. The technology license included in the single performance obligation is considered a functional license. However, it is typically combined into a single performance obligation as we provide interrelated research and development services along with other obligations over an estimated period of performance. We utilize judgment to determine the most appropriate method to measure our progress of performance under

Table of Contents

the agreement, primarily based on inputs necessary to fulfill the performance obligation. We evaluate our measure of progress to recognize revenue each reporting period and, if necessary, adjust the measure of performance and related revenue recognition. Our measure of performance and revenue recognition involves significant judgment and assumptions, including, but not limited to, estimated costs and timelines to complete our performance obligations. We evaluate modifications and amendments to our contracts to determine whether any changes should be accounted for prospectively or on a cumulative catch-up basis.

Payments received for cost reimbursements for research and development efforts are recognized as revenue as the services are performed, in connection with the single performance obligation discussed above. The reimbursements relate specifically to our efforts to provide services and the reimbursements are consistent with what we would typically charge other collaborators for similar services.

We assess the uncertainty of when and if the milestone will be achieved to determine whether the milestone is included in the transaction price. We then assess whether the revenue is constrained based on whether it is probable that a significant reversal of revenue would not occur when the uncertainty is resolved.

Royalties, including sales-based milestones, received under the agreements will be recognized as revenue when sales have occurred because we apply the sales- or usage-based royalties recognition exception provided for under ASC 606. We determined the application of this exception is appropriate because at the time the royalties are generated, the technology license granted in the agreement is the predominant item to which the royalties relate.

As we receive upfront payments in our collaboration and licensing agreements, we evaluate whether any significant financing components exist in our collaboration and licensing agreements. Based on the nature of our collaboration and licensing agreements, there are no significant financing components as the purpose of the upfront payment is not to provide financing. The purpose is to provide the collaborator with assurance that we will complete our obligations under the contract or to secure the right to a specific product or service at the collaborator's discretion. In addition, the variable payments generally align with the timing of performance or the timing of the consideration varies on the basis of the occurrence or nonoccurrence of a future event that is not substantially within the control of the collaborator or us.

From time to time, we and certain collaborators may cancel our agreements, relieving us of any further performance obligations under the agreement. Upon such cancellation or when we have determined no further performance obligations are required of us under an agreement, we recognize any remaining deferred revenue.

We recognized $76.9 million of collaboration and licensing revenues in the year ended December 31, 2018. As of December 31, 2018, we have $63.3 million of deferred revenue related to our receipt of upfront and milestone payments.

Product and service revenues

We generate product and service revenues primarily through sales of products and services that are created from technologies developed or owned by us. Our current offerings include sales of advanced reproductive technologies, including our bovine embryo transfer and in vitro fertilization processes and from genetic preservation and sexed semen processes and applications of such processes to other livestock, as well as sales of livestock and embryos produced using these processes and used in production. As each promised product or service is distinct, we recognize the transaction price as revenue when control of the promised product is transferred to the customer or when the promised service is rendered. Payment terms are typically due within 30 days. We recognized $80.7 million of these product and service revenues for the year ended December 31, 2018.

Revenue recognition (for the years ended December 31, 2017 and 2016)

Collaboration and licensing revenues

We generate collaboration and licensing revenue through collaboration and licensing agreements whereby the collaborators or the licensees obtain exclusive access to our proprietary technologies for use in the research, development and commercialization of products and/or treatments in a contractually specified field of use. Generally, the terms of these agreements provide that we receive some or all of the following: (i) upfront payments upon consummation of the agreement; (ii) reimbursements for costs incurred by us for research and development and/or manufacturing efforts related to specific applications provided for in the agreement; (iii) milestone payments upon the achievement of specified development, regulatory and commercial activities; and (iv) royalties on sales of products

arising from the collaboration or licensing agreement.

Table of Contents

Our collaborations and licensing agreements typically contain multiple elements, or deliverables, including technology licenses, research and development services, and in certain cases manufacturing services. We identify the deliverables within the agreements and evaluate which deliverables represent separate units of accounting. Analyzing the agreements to identify deliverables requires the use of judgment. A deliverable is considered a separate unit of accounting when the deliverable has value to the collaborator or licensee on a standalone basis based on the consideration of the relevant facts and circumstances for each agreement.

Consideration received is allocated at the inception of the agreement to all identified units of accounting based on their relative selling price. When available, the relative selling price for each deliverable is determined using vendor specific objective evidence, or VSOE, of the selling price or third-party evidence of the selling price, if VSOE does not exist. If neither VSOE nor third-party evidence of the selling price exists, we use our best estimate of the selling price for the deliverable. The amount of allocable consideration is limited to amounts that are fixed or determinable. The consideration received is allocated among the separate units of accounting, and the applicable revenue recognition criteria are applied to each of the separate units. We recognize the revenue allocated to each unit of accounting as we deliver the related goods or services. If we determine that certain deliverables should be treated as a single unit of accounting, then the revenue is recognized using either a proportional performance or straight-line method, depending on whether we can reasonably estimate the level of effort required to complete our performance obligations under an arrangement and whether such performance obligations are provided on a best-efforts basis. As we cannot reasonably estimate our performance obligations related to our collaborators or licensees, we recognize revenue on a straight-line basis over the period we expect to complete our performance obligations, which is reevaluated each reporting period.

The terms of our agreements may provide for milestone payments upon achievement of certain defined events. We apply the Milestone Method for recognizing milestone payments. Under the Milestone Method, we recognize consideration that is contingent upon the achievement of a milestone in its entirety as revenue in the period in which the milestone is achieved only if the milestone is substantive in its entirety. A milestone is considered substantive when it meets all of the following criteria:

- The consideration is commensurate with either the entity's performance to achieve the milestone or the enhancement of the value of the delivered item or items as a result of a specific outcome resulting from the entity's performance to achieve the milestone;
- The consideration relates solely to past performance; and
- The consideration is reasonable relative to all of the deliverables and payment terms within the arrangement.

In the event that a milestone is not considered substantive, we recognize the milestone consideration as revenue using the same method applied to the upfront payments.

Research and development services are a deliverable satisfied by us in accordance with the terms of the collaboration and licensing agreements and we consider these services to be inseparable from the license to the core technology; therefore, reimbursements of services performed are recognized as revenue. Because reimbursement (i) is contingent upon performance of the services by us, (ii) does not include a profit component and (iii) does not relate to any future deliverable, the revenue is recognized during the period in which the related services are performed and collection of such amounts is reasonably assured. Payments received for manufacturing services will be recognized when the earnings process related to the manufactured materials has been completed. Royalties to be received under the agreements will be recognized as earned.

From time to time, we and certain collaborators may cancel the agreements, relieving us of any further performance obligations under the agreement. When no further performance obligations are required of us under an agreement, we recognize any remaining deferred revenue.

We recognized $145.6 million and $109.9 million of collaboration and licensing revenues in the years ended December 31, 2017 and 2016, respectively. As of December 31, 2017, we have $230.5 million of deferred revenue related to our receipt of upfront and milestone payments.

Product and service revenues

We generate product and service revenues primarily through sales of products or services that are created from technologies developed or owned by us. Our current offerings include sales of advanced reproductive technologies, including our bovine embryo transfer and in vitro fertilization processes and from genetic preservation and sexed

semen processes and applications of such processes to other livestock, as well as sales of livestock and embryos produced using these processes and used in

Table of Contents

production. Revenue is recognized when (i) persuasive evidence of an arrangement exists, (ii) services have been rendered or delivery has occurred such that risk of loss has passed to the customer, (iii) the price is fixed or determinable, and (iv) collection from the customer is reasonably assured. We recognized $82.3 million, and $77.9 million of these product and service revenues for the years ended December 31, 2017 and 2016, respectively.

Investments in preferred stock

We hold preferred stock in certain of our collaborators, some of which may be converted to common stock as described in "Notes to the Consolidated Financial Statements - Note 7" appearing elsewhere in this Annual Report. We elected the fair value option to account for our investments in preferred stock whereby the value of preferred stock is adjusted to fair value as of each reporting date and unrealized gains and losses are reported in the consolidated statements of operations. These investments are subject to fluctuation in the future due to, among other things, the likelihood and timing of conversion of certain of the preferred stock into common stock, the volatility of each collaborator's common stock, and changes in general economic and financial conditions of the collaborators. These Level 3 investments are classified as noncurrent in the consolidated balance sheet since we do not intend to sell the investment nor expect the investments that are convertible into common stock to be converted within one year. In conjunction with the ZIOPHARM License Agreement in October 2018, our ZIOPHARM preferred shares, valued at $158.3 million, were returned to ZIOPHARM. As of December 31, 2018 and 2017, our investments in preferred stock are valued at $0.2 million and $161.2 million, respectively.

We are entitled to monthly dividends and record dividend income. We recorded $14.8 million and $16.8 million of dividend income in 2018 and 2017, respectively, most of which was related to our investment in ZIOPHARM preferred stock.

Valuation allowance for net deferred tax assets

We record a valuation allowance to offset any net deferred tax assets if, based upon the available evidence, it is more likely than not that we will not recognize some or all of the deferred tax assets. We have had a history of net losses since inception, and as a result, we have established a 100 percent valuation allowance for our net domestic and certain foreign deferred tax assets. If circumstances change and we determine that we will able to realize some or all of these net deferred tax assets in the future, we will record an adjustment to the valuation allowance.

Additionally, enacted changes in domestic or foreign tax rates, such as those as part of the Tax Act, that require remeasurement of our deferred tax assets and liabilities, also require remeasurement of our valuation allowance.

Consolidation of variable interest entities

We identify entities that (i) that do not have sufficient equity investment at risk to permit the entity to finance its activities without additional subordinated financial support, or (ii) in which the equity investors lack an essential characteristic of a controlling financial interest as variable interest entities, or VIEs. We perform an initial and on-going evaluation of the entities with which we have variable interests to determine if any of these entities are VIEs. If an entity is identified as a VIE, we perform an assessment to determine whether we have both: (i) the power to direct activities that most significantly impact the VIE's economic performance, and (ii) have the obligation to absorb losses from or the right to receive benefits of the VIE that could potentially be significant to the VIE. If both of these criteria are satisfied, we are identified as the primary beneficiary of the VIE. As of December 31, 2018 and 2017, we determined that certain of our collaborators and JVs as well as Harvest were VIEs. We were not the primary beneficiary for these entities since we did not have the power to direct the activities that most significantly impact the economic performance of the VIEs. Our aggregate investment balance of these VIEs as of December 31, 2018 and 2017, was $21.2 million and $185.3 million, respectively, which represents our maximum risk of loss related to the identified VIEs.

Valuation of goodwill and long-lived assets

We evaluate long-lived assets to be held and used, which include property, plant and equipment and intangible assets subject to amortization, for impairment whenever events or changes in circumstances indicate that the carrying amount of the assets may not be recoverable. Conditions that would necessitate an impairment assessment include a significant decline in the observable market value of an asset, a significant change in the extent or manner an asset is used, or a significant adverse change that would indicate that the carrying amount of an asset or group of assets is not recoverable.

Goodwill is tested for impairment annually, or more frequently if events or circumstances between annual tests indicate that the assets may be impaired. Impairment losses on goodwill are recognized based solely on a comparison of their fair value to carrying value, without consideration of any recoverability test.

Table of Contents

During the years ended December 31, 2018 and 2017, we recorded $60.5 million and $16.8 million, respectively, of impairment charges to write down the values of goodwill and intangible assets recorded in certain of our prior acquisitions. See additional discussion regarding this impairment in "Notes to the Consolidated Financial Statements - Note 11" appearing elsewhere in this Annual Report.

Recent accounting pronouncements

See "Notes to the Consolidated Financial Statements - Note 2" appearing elsewhere in this Annual Report for a description of recent accounting pronouncements applicable to our business, which is incorporated herein by reference.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk

The following sections provide quantitative information on our exposure to interest rate risk, stock price risk, and foreign currency exchange risk. We make use of sensitivity analyses that are inherently limited in estimating actual losses in fair value that can occur from changes in market conditions.

Interest rate risk

We had cash, cash equivalents and short-term investments of $222.5 million and $74.4 million as of December 31, 2018 and 2017, respectively. Our cash and cash equivalents and short-term investments consist of cash, money market funds, United States government debt securities, and certificates of deposit. The primary objectives of our investment activities are to preserve principal, maintain liquidity and maximize income without significantly increasing risk. Our investments consist of United States government debt securities and certificates of deposit, which may be subject to market risk due to changes in prevailing interest rates that may cause the fair values of our investments to fluctuate. We believe that a hypothetical 100 basis point increase in interest rates would not materially affect the fair value of our interest-sensitive financial instruments and any such losses would only be realized if we sold the investments prior to maturity.

Investments in publicly traded companies' common stock

As of December 31, 2018, we owned 8,239,199 shares or approximately 55 percent of the common stock of AquaBounty, which is traded on the NASDAQ Stock Market. The fair value of our investment in AquaBounty as of December 31, 2018 and 2017, based on AquaBounty's quoted closing price on the NASDAQ Stock Market, was $16.9 million and $18.2 million, respectively. The fair value of our investment in AquaBounty as of December 31, 2018 would be approximately $18.6 million and $13.5 million, respectively, based on a hypothetical 10 percent increase or 20 percent decrease in the share price of AquaBounty. The fair value of our investment in AquaBounty as of December 31, 2017 would be approximately $20.0 million and $14.6 million, respectively, based on a hypothetical 10 percent increase or 20 percent decrease in the share price of AquaBounty.

Foreign currency exchange risk

We have international subsidiaries in a number of countries, including Belgium, Brazil, Canada, Hungary, and the United Kingdom. These subsidiaries' assets, liabilities, and current revenues and expenses are denominated in their respective foreign currency. We do not hedge our foreign currency exchange rate risk. The effect of a hypothetical 10 percent change in foreign currency exchange rates applicable to our business would not have a material impact on our consolidated financial statements.

Item 8. Financial Statements and Supplementary Data

The information required by this Item 8 is contained on pages F-1 through F-60 of this Annual Report and is incorporated herein by reference.

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

None.

Table of Contents

Item 9A. Controls and Procedures

Evaluation of Disclosure Controls and Procedures

Management, with the participation of our chief executive officer and our chief financial officer, evaluated the effectiveness of our disclosure controls and procedures as of December 31, 2018. 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 their evaluation of our disclosure controls and procedures as of December 31, 2018, our chief executive officer and chief financial officer have 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 as such term is defined in Rules 13a-15(f) and Rule 15d-15(f) of the Exchange Act. Our 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. Our 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 our assets;

(ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of consolidated financial statements in accordance with generally accepted accounting principles, and that our receipts and expenditures are being made only in accordance with authorizations of our management and directors; and

(iii) 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 consolidated 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.

Our management assessed the effectiveness of our internal control over financial reporting as of December 31, 2018. In making this assessment, our 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 this evaluation, management concluded that our internal control over financial reporting was effective as of December 31, 2018. PricewaterhouseCoopers LLP, an independent registered public accounting firm, has audited the effectiveness of our internal control over financial reporting as of December 31, 2018, as stated in their report, which is included in Part II Item 8 of this Annual Report.

Remediation of Material Weakness in Internal Control Over Financial Reporting

A material weakness if a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the annual or interim financial statements will not be prevented or detected on a timely basis.

During the second quarter of 2018, we identified and disclosed a material weakness in our internal control over financial reporting relating to controls over the adoption of ASC 606. Specifically, we did not design controls which were sufficiently precise to identify and account for the impacts of adopting ASC 606 on our open ECCs, including gross versus net presentation for payments pursuant to one of our contracts, the guidance for contract modifications to

a contract that had been modified prior to the adoption of ASC 606, and the measurement of progress for performance obligations satisfied over time. This

Table of Contents

control deficiency resulted in the misstatement of accumulated deficit, deferred revenue, and collaboration and licensing revenues, and restatement of our consolidated financial statements for the quarter ended March 31, 2018. To remediate the material weakness described above, we (i) engaged third-party technical accounting advisors on complex matters that fell within the scope of ASC 606; (ii) designed and implemented a more precise review framework whereby our advisors provided, and we reviewed, a more detailed assessment of how ASC 606 applies to all key elements of our contracts with customers; (iii) designed and implemented controls, including a comprehensive review of such deliverables and conclusions by management via a sufficiently detailed analysis of the relevant contracts, amendments, accounting guidance and related interpretations; and (iv) designed and implemented controls related to the ongoing revenue recognition accounting for our ECCs.

During the fourth quarter of 2018, we completed the testing of the changes noted above. Based on the evidence obtained in validating the design and operating effectiveness of these controls, we concluded that these changes to our controls and procedures have remediated the material weakness in our internal control over financial reporting as of December 31, 2018.

Changes in Internal Control Over Financial Reporting

There have been no changes in our internal control over financial reporting during the quarter ended December 31, 2018 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information

None.

Table of Contents

PART III

Item 10. Directors, Executive Officers and Corporate Governance

The information required by this item is hereby incorporated by reference to our Definitive Proxy Statement relating to our 2019 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2018.

Our board of directors has adopted a Code of Business Conduct and Ethics applicable to all officers, directors and employees, which is available on our website (investors.dna.com) under "Corporate Governance." We will provide a copy of this document, without charge, upon request, by writing to us at Intrexon Corporation, 20374 Seneca Meadows Parkway, Germantown, Maryland 20876, Attention: Investor Relations. We intend to satisfy the disclosure requirement under Item 5.05 of Form 8-K regarding amendment to, or waiver from, a provision of our Code of Business Conduct and Ethics by posting such information on our website at the address and location specified above.

Item 11. Executive Compensation

The information required by this item is hereby incorporated by reference to our Definitive Proxy Statement relating to our 2019 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2018.

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

The information required by this item is hereby incorporated by reference to our Definitive Proxy Statement relating to our 2019 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2018.

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

The information required by this item is hereby incorporated by reference to our Definitive Proxy Statement relating to our 2019 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2018.

Item 14. Principal Accounting Fees and Services

The information required by this item is hereby incorporated by reference to our Definitive Proxy Statement relating to our 2019 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2018.

Table of Contents

PART IV

Item 15. Exhibits, Financial Statement Schedules

(a) The following consolidated financial statements of Intrexon Corporation and its subsidiaries, and the independent registered public accounting firm reports thereon, are included in Part II, Item 8 of this Annual Report:

1. Financial Statements.

Consolidated Financial Statements of Intrexon Corporation and Subsidiaries
Report of Independent Registered Public Accounting Firm
Consolidated Balance Sheets as of December 31, 2018 and 2017
Consolidated Statements of Operations for the Years Ended December 31, 2018, 2017, and 2016
Consolidated Statements of Comprehensive Loss for the Years Ended December 31, 2018, 2017, and 2016
Consolidated Statements of Shareholders' and Total Equity for the Years Ended December 31, 2018, 2017 and 2016
Consolidated Statements of Cash Flows for the Years Ended December 31, 2018, 2017, and 2016
Notes to the Consolidated Financial Statements

2. Financial Statement Schedules.

All financial statement schedules have been omitted because either the required information is not applicable or the information required is included in the consolidated financial statements and notes thereto included in this Annual Report.

3. Exhibits.

The exhibits are listed in Item 15(b) below.

(b) Exhibits

The following exhibits are filed with this Annual Report or incorporated by reference:

Exhibit No.	Description
1.1*	Controlled Equity OfferingSM Sales Agreement between Intrexon and Cantor Fitzgerald & Co., dated November 11, 2015 (11)
2.1*	Agreement and Plan of Merger, dated as of January 24, 2017, by and among Intrexon, GenVec and Intrexon GV Holding, Inc. (18)
3.1*	Amended and Restated Articles of Incorporation (3)
3.1A*	Articles of Amendment to the Amended and Restated Articles of Incorporation (21)
3.2*	Amended and Restated Bylaws (12)
4.1*	Specimen certificate evidencing shares of common stock (2)
4.2*	Form of Second Amended and Restated Warrant to Purchase Shares of Common Stock (2)
4.3*	Eighth Amended and Restated Investors' Rights Agreement, dated March 1, 2013, by and among Intrexon and the holders of the Company's preferred stock and certain holders of Intrexon's common stock and Joinder thereto (1)

Table of Contents

4.4*	Base Indenture, dated July 3, 2018, by and between Intrexon Corporation and The Bank of New York Mellon Trust Company, N.A. (26)
4.5*	First Supplemental Indenture (including the form of 3.50% convertible senior notes due 2023), dated July 3, 2018, by and between Intrexon Corporation and The Bank of New York Mellon Trust Company, N.A. (26)
10.1†*	Intrexon Corporation Amended and Restated 2008 Equity Incentive Plan (2)
10.2†*	Intrexon Corporation Amended and Restated 2013 Omnibus Incentive Plan, effective as of June 9, 2014 (7)
10.2A†*	Intrexon Corporation Amended and Restated 2013 Omnibus Incentive Plan, Form of Restricted Stock Agreement (7)
10.2B†*	Intrexon Corporation Amended and Restated 2013 Omnibus Incentive Plan, Form of Incentive Stock Option Agreement (7)
10.2C†*	Intrexon Corporation Amended and Restated 2013 Omnibus Incentive Plan, Form of Nonqualified Stock Option Agreement (7)
10.2D†*	Amendment to the Intrexon Corporation Amended and Restated 2013 Omnibus Incentive Plan, effective as of June 11, 2015 (9)
10.2E†*	Amendment to the Intrexon Corporation Amended and Restated 2013 Omnibus Incentive Plan, effective as of June 9, 2016 (13)
10.2F†*	Amendment to the Intrexon Corporation Amended and Restated 2013 Omnibus Incentive Plan, effective as of June 28, 2017 (19)
10.2G†*	Amendment to the Intrexon Corporation Amended and Restated 2013 Omnibus Incentive Plan, as amended, effective as of June 7, 2018 (25)
10.2H†*	Intrexon Corporation 2013 Amended and Restated Omnibus Incentive Plan, as amended, Restricted Stock Unit Agreement, by and between Intrexon and Randal J. Kirk, effective as of November 1, 2015 (10)
10.2I†*	Intrexon Corporation 2013 Amended and Restated Omnibus Incentive Plan, as amended, Restricted Stock Unit Agreement, by and between Intrexon and Randal J. Kirk, effective as of November 1, 2016 (15)
10.2J†*	Intrexon Corporation 2013 Amended and Restated Omnibus Incentive Plan, as amended, Restricted Stock Unit Agreement, by and between Intrexon and Randal J. Kirk, dated as of December 30, 2016 (16)
10.2K†*	Intrexon Corporation 2013 Amended and Restated Omnibus Incentive Plan, as amended, Restricted Stock Unit Agreement, by and between Intrexon and Randal J. Kirk, effective as of April 1, 2017 (17)
10.2L†*	Intrexon Corporation 2013 Amended and Restated Omnibus Incentive Plan, as amended, Restricted Stock Unit Agreement, by and between Intrexon Corporation and Randal J. Kirk, effective as of April 1, 2018 (24)
10.2M†*	Intrexon Corporation 2013 Amended and Restated Omnibus Incentive Plan, as amended, Form of Restricted Stock Unit Agreement for Officers (23)

10.2N†*	Intrexon Corporation 2013 Amended and Restated Omnibus Incentive Plan, as amended, Form of Restricted Stock Unit Agreement for Directors (23)
10.3*	Exclusive Channel Partner Agreement, dated as of January 6, 2011, between Intrexon and ZIOPHARM Oncology, Inc., as amended (1)
10.3A*	Second Amendment to Exclusive Channel Partner Agreement, dated March 27, 2015, between Intrexon and ZIOPHARM Oncology, Inc. (8)
10.3B*	Third Amendment to Exclusive Channel Partner Agreement by and between ZIOPHARM Oncology, Inc. and Intrexon Corporation dated as of June 29, 2016 (14)
10.3C*	Amendment to Exclusive Channel Collaboration Agreement by and between ZIOPHARM Oncology, Inc. and Intrexon Corporation dated as of June 29, 2016 (14)
10.4#*	Exclusive Channel Collaboration Agreement, dated as of February 14, 2013, between Intrexon and AquaBounty Technologies, Inc. (1)
10.5*	Relationship Agreement, dated as of December 5, 2012, between Intrexon and AquaBounty Technologies, Inc. (1)
10.6#*	Exclusive Channel Collaboration Agreement, dated as of March 29, 2013, between Intrexon and Genopaver, LLC (1)

Table of Contents

10.7†*	Second Amended and Restated Employment Agreement, dated as of August 31, 2006, between Intrexon and Thomas D. Reed (2)
10.8#*	Exclusive Channel Collaboration Agreement, dated as of March 26, 2014, by and between Intrexon Corporation and Intrexon Energy Partners, LLC (4)
10.9#*	Amended and Restated Limited Liability Company Agreement of Intrexon Energy Partners, LLC, dated as of March 26, 2014, by and among Intrexon and the parties thereto (4)
10.10*	Letter Agreement by and between ZIOPHARM Oncology, Inc., Intrexon and The University of Texas System Board of Regents on behalf of The University of Texas MD Anderson Cancer Center, dated as of January 9, 2015 (5)
10.11*	Securities Issuance Agreement by and among Intrexon, The University of Texas System Board of Regents on behalf of The University of Texas MD Anderson Cancer Center dated as of January 13, 2015 (5)
10.12*	Securities Issuance Agreement by and among Intrexon, The University of Texas System Board of Regents on behalf of The University of Texas MD Anderson Cancer Center dated as of January 13, 2015 (5)
10.13*	Registration Rights Agreement by and among Intrexon, The University of Texas System Board of Regents on behalf of The University of Texas MD Anderson Cancer Center dated as of January 13, 2015 (5)
10.14#*	License Agreement by and among ZIOPHARM Oncology, Inc., Intrexon and The University of Texas System Board of Regents on behalf of The University of Texas MD Anderson Cancer Center, dated as of January 13, 2015 (6)
10.15#*	License Agreement, dated October 5, 2018, by and between Precigen, Inc. and ZIOPHARM Oncology, Inc. (27)
10.16#*	License and Collaboration Agreement, dated as of March 27, 2015, among Intrexon, ARES Trading S.A. and ZIOPHARM Oncology, Inc. (8)
10.17†*	Intrexon Corporation Annual Executive Incentive Plan, adopted as of April 29, 2015 (9)
10.18*	Services Agreement, by and between Intrexon Corporation and Third Security, LLC, effective as of November 1, 2015 (10)
10.18A*	First Amendment to Services Agreement, by and between Intrexon Corporation and Third Security, LLC, effective as of October 31, 2016 (15)
10.18B*	Second Amendment to Services Agreement, by and between Intrexon Corporation and Third Security, LLC, effective as of December 30, 2016 (16)
10.18C*	Third Amendment to Services Agreement, by and between Intrexon Corporation and Third Security, LLC, dated as of December 28, 2017 (22)
10.19*	Share Lending Agreement, dated June 28, 2018, by and between Intrexon Corporation, J.P. Morgan Securities LLC and JPMorgan Chase Bank, National Association, New York Branch (26)

10.20†*	Preferred Stock Equity Facility Agreement, dated October 16, 2017, by and between Kapital Joe, LLC and Intrexon Corporation (20)
10.21†*	Termination of Preferred Stock Equity Facility Agreement, dated June 28, 2018 (26)
10.22#**	Securities Purchase, Assignment and Assumption Agreement, dated December 19, 2018, by and between Intrexon Corporation, ARES TRADING S.A. and Precigen, Inc.
10.23#**	Convertible Note issued to ARES TRADING S.A., dated December 28, 2018
21.1	List of Subsidiaries of Intrexon Corporation
23.1	Consent of PricewaterhouseCoopers LLP
31.1	Certification of Randal J. Kirk, Chairman and Chief Executive Officer (Principal Executive Officer) of Intrexon Corporation, pursuant to Rules 13a-14(a) and 15d-14(a) promulgated under the Securities Exchange Act of 1934, as amended, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002
31.2	Certification of Rick L. Sterling, Chief Financial Officer (Principal Financial Officer) of Intrexon Corporation, pursuant to Rules 13a-14(a) and 15d-14(a) promulgated under the Securities Exchange Act of 1934, as amended, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002

Table of Contents

32.1**	Certification of Randal J. Kirk, Chairman and Chief Executive Officer (Principal Executive Officer) of Intrexon Corporation, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002
32.2**	Certification of Rick L. Sterling, Chief Financial Officer (Principal Financial Officer) of Intrexon Corporation, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002
101**	Interactive Data File (Intrexon Corporation and Subsidiaries Consolidated Financial Statements for the years ended December 31, 2018, 2017 and 2016, formatted in XBRL (eXtensible Business Reporting Language)). Attached as Exhibit 101 are the following documents formatted in XBRL: (i) the Consolidated Balance Sheets as of December 31, 2018 and 2017, (ii) the Consolidated Statements of Operations for the years ended December 31, 2018, 2017 and 2016, (iii) the Consolidated Statements of Shareholders' and Total Equity for the years ended December 31, 2018, 2017 and 2016, (iv) the Consolidated Statements of Cash Flows for the years ended December 31, 2018, 2017 and 2016 and (v) the Notes to the Consolidated Financial Statements.

*Previously filed and incorporated by reference to the exhibit indicated in the following filings by Intrexon:

(1) Registration Statement on Form S-1, filed with the Securities and Exchange Commission on July 9, 2013.
(2) Amendment No. 1 to Registration Statement on Form S-1, filed with the Securities and Exchange Commission on July 29, 2013.
(3) Current Report on Form 8-K, filed with the Securities and Exchange Commission on August 15, 2013.
(4) Current Report on Form 8-K/A, filed with the Securities and Exchange Commission on April 4, 2014.
(5) Current Report on Form 8-K, filed with the Securities and Exchange Commission on January 14, 2015.
(6) Current Report on Form 8-K/A, filed with the Securities and Exchange Commission on January 28, 2015.
(7) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 13, 2014.
(8) Current Report on Form 8-K, filed with the Securities and Exchange Commission on April 2, 2015.
(9) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 17, 2015.
(10) Current Report on Form 8-K/A, filed with the Securities and Exchange Commission on November 3, 2015.
(11) Current Report on Form 8-K, filed with the Securities and Exchange Commission on November 12, 2015.
(12) Current Report on Form 8-K, filed with the Securities and Exchange Commission on March 14, 2016.
(13) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 13, 2016.
(14) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 30, 2016.
(15) Current Report on Form 8-K, filed with the Securities and Exchange Commission on November 3, 2016.
(16) Current Report on Form 8-K, filed with the Securities and Exchange Commission on December 30, 2016.
(17) Current Report on Form 8-K, filed with the Securities and Exchange Commission on March 31, 2017.
(18) Amendment No. 2 to the Registration Statement on Form S-4, filed with the Securities and Exchange Commission on May 11, 2017.
(19) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 30, 2017.
(20) Current Report on Form 8-K, filed with the Securities and Exchange Commission on October 16, 2017.

Table of Contents

(21) Quarterly Report on Form 10-Q, filed with the Securities and Exchange Commission on November 9, 2017.
(22) Current Report on Form 8-K, filed with the Securities and Exchange Commission on January 2, 2018.
(23) Annual Report on Form 10-K, filed with the Securities and Exchange Commission on March 1, 2018.
(24) Current Report on Form 8-K, filed with the Securities and Exchange Commission on April 5, 2018.
(25) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 8, 2018.
(26) Current Report on Form 8-K, filed with the Securities and Exchange Commission on July 3, 2018.
(27) Quarterly Report on Form 10-Q, filed with the Securities and Exchange Commission on November 8, 2018.
** Furnished herewith
† Indicates management contract or compensatory plan.
# Portions of the exhibit (indicated by asterisks) have been omitted pursuant to a confidential treatment order granted by the Securities and Exchange Commission.
(c) Financial Statement Schedules
The response to Item 15(a)2 is incorporated herein by reference.
Item 16. Form 10-K Summary
None.

Table of Contents

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, as amended, the Registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.
Dated: March 1, 2019

INTREXON CORPORATION

By: /S/ RANDAL J. KIRK
Randal J. Kirk
Chief Executive Officer and Chairman of the Board of Directors

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

Signature	Title	Date
/S/ RANDAL J. KIRK Randal J. Kirk	Chief Executive Officer and Chairman of the Board of Directors (Principal Executive Officer)	3/1/2019
/S/ RICK L. STERLING Rick L. Sterling	Chief Financial Officer (Principal Accounting and Financial Officer)	3/1/2019
/S/ CESAR L. ALVAREZ Cesar L. Alvarez	Director	2/28/2019
/S/ STEVEN FRANK Steven Frank	Director	2/28/2019
/S/ VINITA D. GUPTA Vinita D. Gupta	Director	2/28/2019
/S/ FRED HASSAN Fred Hassan	Director	2/28/2019
/S/ JEFFREY B. KINDLER Jeffrey B. Kindler	Director	2/28/2019
/S/ DEAN J. MITCHELL Dean J. Mitchell	Director	2/28/2019
/S/ ROBERT B. SHAPIRO Robert B. Shapiro	Director	2/28/2019
/S/ JAMES S. TURLEY James S. Turley	Director	2/28/2019

Table of Contents

Index to the Financial Statements and Schedules

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Financial Statements
December 31, 2018, 2017 and 2016

Table of Contents

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of Intrexon Corporation

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of Intrexon Corporation and its subsidiaries (the "Company") as of December 31, 2018 and 2017, and the related consolidated statements of operations, of comprehensive loss, of shareholders' and total equity and of cash flows for each of the three years in the period ended December 31, 2018, 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, 2018, 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, 2018 and 2017, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2018 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, 2018, based on criteria established in Internal Control - Integrated Framework (2013) issued by the COSO.

Substantial Doubt About the Company's Ability to Continue as a Going Concern

The accompanying consolidated financial statements have been prepared assuming that the Company will continue as a going concern. As discussed in Note 1 to the consolidated financial statements, the Company has suffered recurring losses, cash outflows from operations and has an accumulated deficit that raise substantial doubt about its ability to continue as a going concern. Management's plans in regard to these matters are also described in Note 1. The consolidated financial statements do not include any adjustments that might result from the outcome of this uncertainty.

Change in Accounting Principle

As discussed in Note 2 to the consolidated financial statements, the Company changed the manner in which it accounts for revenues from contracts with customers in 2018.

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.

Table of Contents

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.

/s/ PricewaterhouseCoopers LLP

Raleigh, North Carolina
March 1, 2019

We have served as the Company's auditor since 2006.

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Balance Sheets
December 31, 2018 and 2017

(Amounts in thousands, except share data)	2018	2017
Assets		
Current assets		
Cash and cash equivalents	$102,768	$68,111
Restricted cash	6,987	6,987
Short-term investments	119,688	6,273
Equity securities	384	5,285
Receivables		
Trade, net	21,195	19,775
Related parties, net	4,129	17,913
Other, net	2,754	2,153
Inventory	21,447	20,493
Prepaid expenses and other	6,131	7,057
Total current assets	285,483	154,047
Equity securities, noncurrent	1,798	9,815
Investments in preferred stock	191	161,225
Property, plant and equipment, net	128,874	112,674
Intangible assets, net	129,291	232,877
Goodwill	149,585	153,289
Investments in affiliates	18,859	18,870
Other assets	2,096	4,054
Total assets	$716,177	$846,851

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

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Balance Sheets
December 31, 2018 and 2017

(Amounts in thousands, except share data)	2018	2017
Liabilities and Total Equity		
Current liabilities		
Accounts payable	$13,420	$8,701
Accrued compensation and benefits	10,687	6,474
Other accrued liabilities	20,620	21,080
Deferred revenue, including $6,945 and $29,155 from related parties as of December 31, 2018 and 2017, respectively	15,554	42,870
Lines of credit	466	233
Current portion of long-term debt	559	502
Related party payables	256	313
Total current liabilities	61,562	80,173
Long-term debt, net of current portion, including $55,290 to related parties as of December 31, 2018	211,235	7,535
Deferred revenue, net of current portion, including $52,227 and $157,628 from related parties as of December 31, 2018 and 2017, respectively	54,210	193,527
Deferred tax liabilities, net	7,213	15,620
Other long-term liabilities	3,235	3,451
Total liabilities	337,455	300,306
Commitments and contingencies (Note 16)		
Total equity		
Common stock, no par value, 200,000,000 shares authorized as of December 31, 2018 and 2017; and 160,020,466 shares and 122,087,040 shares issued and outstanding as of December 31, 2018 and 2017, respectively	—	—
Additional paid-in capital	1,722,012	1,397,005
Accumulated deficit	(1,330,545)	(847,820)
Accumulated other comprehensive loss	(28,612)	(15,554)
Total Intrexon shareholders' equity	362,855	533,631
Noncontrolling interests	15,867	12,914
Total equity	378,722	546,545
Total liabilities and total equity	$716,177	$846,851

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

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Statements of Operations
Years Ended December 31, 2018, 2017 and 2016

(Amounts in thousands, except share and per share data)	2018	2017	2016
Revenues			
Collaboration and licensing revenues, including $60,238, $130,670, and $93,792 from related parties in 2018, 2017, and 2016, respectively	$ 76,869	$ 145,579	$ 109,871
Product revenues	28,528	33,589	36,958
Service revenues	52,419	50,611	43,049
Other revenues	2,758	1,202	1,048
Total revenues	160,574	230,981	190,926
Operating Expenses			
Cost of products	35,698	33,263	37,709
Cost of services	27,589	29,525	23,930
Research and development	404,586	143,207	112,135
Selling, general and administrative	137,807	146,103	142,318
Impairment loss	60,504	16,773	—
Total operating expenses	666,184	368,871	316,092
Operating loss	(505,610)	(137,890)	(125,166)
Other Income (Expense), Net			
Unrealized and realized appreciation (depreciation) in fair value of equity securities and preferred stock	(30,200)	2,586	(58,894)
Interest expense	(8,530)	(611)	(861)
Interest and dividend income	19,084	19,485	10,190
Other income, net	630	1,013	1,700
Total other income (expense), net	(19,016)	22,473	(47,865)
Equity in net loss of affiliates	(11,608)	(14,283)	(21,120)
Loss before income taxes	(536,234)	(129,700)	(194,151)
Income tax benefit	21,528	2,880	3,877
Net loss	$ (514,706)	$ (126,820)	$ (190,274)
Net loss attributable to the noncontrolling interests	5,370	9,802	3,662
Net loss attributable to Intrexon	$ (509,336)	$ (117,018)	$ (186,612)
Net loss attributable to Intrexon per share, basic and diluted	$ (3.93)	$ (0.98)	$ (1.58)
Weighted average shares outstanding, basic and diluted	129,521,731	119,998,826	117,983,836

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

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Statements of Comprehensive Loss
Years Ended December 31, 2018, 2017 and 2016

(Amounts in thousands)	2018	2017	2016
Net loss	$(514,706)	$(126,820)	$(190,274)
Other comprehensive income (loss):			
Unrealized gain (loss) on investments	(59)	87	430
Gain (loss) on foreign currency translation adjustments	(13,073)	20,599	(23,901)
Comprehensive loss	(527,838)	(106,134)	(213,745)
Comprehensive loss attributable to the noncontrolling interests	5,548	9,764	3,683
Comprehensive loss attributable to Intrexon	$(522,290)	$(96,370)	$(210,062)

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

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Statements of Shareholders' and Total Equity
Years Ended December 31, 2018, 2017 and 2016

(Amounts in thousands, except share data)	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Intrexon Shareholders Equity	Noncontrolling Interests	Total Equity
	Shares	Amount						
Balances at December 31, 2015	116,658,886	$ —	$ 1,249,559	$ (12,752)	$ (542,729)	$ 694,078	$ 10,808	$ 704,886
Stock-based compensation expense	—	—	42,108	—	—	42,108	73	42,181
Exercises of stock options and warrants	1,400,146	—	19,165	—	—	19,165	—	19,165
Shares issued as payment for services	434,061	—	10,777	—	—	10,777	—	10,777
Shares issued in asset acquisition	136,340	—	4,401	—	—	4,401	—	4,401
Shares issued as payment for contingent consideration	59,337	—	1,583	—	—	1,583	—	1,583
Acquisition of noncontrolling interest	—	—	(1,813)	—	—	(1,813)	1,813	—
Net loss	—	—	—	—	(186,612)	(186,612)	(3,662)	(190,274)
Other comprehensive loss	—	—	—	(23,450)	—	(23,450)	(21)	(23,471)
Balances at December 31, 2016	118,688,770	$ —	$ 1,325,780	$ (36,202)	$ (729,341)	$ 560,237	$ 9,011	$ 569,248

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

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Statements of Shareholders' and Total Equity
Years Ended December 31, 2018, 2017 and 2016

(Amounts in thousands, except share data)	Common Stock Shares	Amount	Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Intrexon Shareholders Equity	Noncontrolling Interests	Total Equity
Balances at December 31, 2016	118,688,770	$ —	$ 1,325,780	$ (36,202)	$ (729,341)	$ 560,237	$ 9,011	$ 569,248
Cumulative effect of adoption of ASU 2016-09	—	—	1,461	—	(1,461)	—	—	—
Stock-based compensation expense	—	—	41,525	—	—	41,525	51	41,576
Exercises of stock options and warrants	149,429	—	952	—	—	952	28	980
Shares issued as payment for services	654,456	—	11,118	—	—	11,118	—	11,118
Shares issued in private placement	1,207,980	—	13,686	—	—	13,686	—	13,686
Shares and warrants issued in business combination	684,240	—	16,997	—	—	16,997	—	16,997
Acquisitions of noncontrolling interests	221,743	—	5,082	—	—	5,082	(5,995)	(913)
Shares issued as payment of deferred consideration	480,422	—	—	—	—	—	—	—
Adjustments for noncontrolling interests	—	—	2,789	—	—	2,789	(2,802)	(13)
Noncash dividend	—	—	(22,385)	—	—	(22,385)	22,385	—
Net loss	—	—	—	—	(117,018)	(117,018)	(9,802)	(126,820)
Other comprehensive income	—	—	—	20,648	—	20,648	38	20,686
Balances at December 31, 2017	122,087,040	$ —	$ 1,397,005	$ (15,554)	$ (847,820)	$ 533,631	$ 12,914	$ 546,545

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

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Statements of Shareholders' and Total Equity
Years Ended December 31, 2018, 2017 and 2016

(Amounts in thousands, except share data)	Common Stock Shares	Amount	Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Intrexon Shareholders' Equity	Noncontrolling Interests	Total Equity
Balances at December 31, 2017	122,087,040	$ —	$1,397,005	$ (15,554)	$(847,820)	$ 533,631	$ 12,914	$546,545
Cumulative effect of adoption of ASC 606	—	—	—	(104)	26,611	26,507	—	26,507
Stock-based compensation expense	—	—	36,174	—	—	36,174	122	36,296
Shares issued upon vesting of restricted stock units and for exercises of stock options and warrants	70,159	—	297	—	—	297	2,039	2,336
Shares issued as payment for services	909,980	—	10,695	—	—	10,695	—	10,695
Shares and warrants issued in public offerings, net of issuance costs	6,900,000	—	82,374	—	—	82,374	5,616	87,990
Equity component of convertible debt, net of issuance costs and deferred taxes	—	—	36,868	—	—	36,868	—	36,868
Shares issued pursuant to share lending agreement	7,479,431	—	—	—	—	—	—	—
Shares issued for reacquired in-process research and development	22,573,856	—	159,323	—	—	159,323	—	159,323
Adjustments for noncontrolling interests	—	—	(724)	—	—	(724)	724	—
Net loss	—	—	—	—	(509,336)	(509,336)	(5,370)	(514,706)
Other comprehensive loss	—	—	—	(12,954)	—	(12,954)	(178)	(13,132)
Balances at December 31, 2018	160,020,466	$ —	$1,722,012	$ (28,612)	$(1,330,545)	$ 362,855	$ 15,867	$378,722

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

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Statements of Cash Flows
Years Ended December 31, 2018, 2017 and 2016

(Amounts in thousands)	2018	2017	2016
Cash flows from operating activities			
Net loss	$(514,706)	$(126,820)	$(190,274)
Adjustments to reconcile net loss to net cash used in operating activities:			
Depreciation and amortization	33,112	31,145	24,572
Loss on abandonment and disposal of assets, net	20,928	3,124	666
Impairment loss	60,504	16,773	—
Reacquisition of in-process research and development	236,748	—	—
Unrealized and realized (appreciation) depreciation on equity securities and preferred stock, net	30,200	(2,586)	58,894
Noncash dividend income	(14,841)	(16,756)	(7,421)
Amortization of premiums (discounts) on investments, net	(771)	411	1,070
Equity in net loss of affiliates	11,608	14,283	21,120
Stock-based compensation expense	36,296	41,576	42,202
Shares issued as payment for services	10,695	11,118	10,777
Provision for bad debts	1,779	1,217	1,963
Accretion of debt discount and amortization of deferred financing costs	4,378	—	—
Deferred income taxes	(21,278)	(2,528)	(3,467)
Other noncash items	1,093	(517)	1,662
Changes in operating assets and liabilities:			
Receivables:			
Trade	(2,698)	740	2,588
Related parties	11,003	631	6,804
Notes	—	—	(42)
Other	(542)	661	271
Inventory	(478)	663	3,807
Prepaid expenses and other	1,006	492	(932)
Other assets	652	(1,017)	2,189
Accounts payable	4,680	(3,402)	3,618
Accrued compensation and benefits	4,385	(1,466)	(12,402)
Other accrued liabilities	356	3,007	9,002
Deferred revenue	(38,578)	(75,337)	(25,481)
Deferred consideration	—	(313)	(630)
Related party payables	(52)	(147)	310
Other long-term liabilities	281	1,328	146
Net cash used in operating activities	(124,240)	(103,720)	(48,988)

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

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Statements of Cash Flows
Years Ended December 31, 2018, 2017 and 2016

(Amounts in thousands)	2018	2017	2016
Cash flows from investing activities			
Purchases of investments	(178,681)	—	(75,246)
Maturities of investments	65,975	174,542	101,987
Purchases of equity securities, preferred stock, and warrants	—	(1,161)	(2,308)
Proceeds from sales of equity securities	217	235	280
Acquisitions of businesses, net of cash received	(920)	2,054	—
Investments in affiliates	(16,582)	(11,189)	(11,542)
Return of investment in affiliate	2,598	—	—
Cash received (paid) in asset acquisitions	15,500	(14,219)	(7,244)
Purchases of property, plant and equipment	(41,587)	(46,666)	(31,629)
Proceeds from sale of assets	2,267	1,636	274
Issuances of notes receivable	—	(2,400)	(2,964)
Proceeds from repayment of notes receivable	—	1,500	—
Net cash provided by (used in) investing activities	(151,213)	104,332	(28,392)
Cash flows from financing activities			
Proceeds from issuance of shares in a private placement	—	13,686	—
Proceeds from issuance of shares and warrants in public offerings, net of issuance costs	87,990	—	—
Acquisitions of noncontrolling interests	—	(913)	—
Advances from lines of credit	4,561	5,906	5,075
Repayments of advances from lines of credit	(4,328)	(6,493)	(4,816)
Proceeds from long-term debt, net of issuance costs	219,859	325	547
Payments of long-term debt	(623)	(519)	(1,201)
Payments of deferred consideration for acquisitions	—	(8,678)	(6,705)
Proceeds from stock option and warrant exercises	2,336	980	19,165
Payment of stock issuance costs	—	(10)	—
Net cash provided by financing activities	309,795	4,284	12,065
Effect of exchange rate changes on cash, cash equivalents, and restricted cash	295	1,055	(873)
Net increase (decrease) in cash, cash equivalents, and restricted cash	34,637	5,951	(66,188)
Cash, cash equivalents, and restricted cash			
Beginning of period	75,545	69,594	135,782
End of period	$110,182	$75,545	$69,594

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

Table of Contents

Intrexon Corporation and Subsidiaries
Consolidated Statements of Cash Flows
Years Ended December 31, 2018, 2017 and 2016

(Amounts in thousands)	2018	2017	2016
Supplemental disclosure of cash flow information			
Cash paid during the period for interest	$3,868	$617	$964
Cash paid during the period for income taxes	216	566	10
Significant noncash financing and investing activities			
Stock received as consideration for collaboration agreements	$—	$—	$18,766
Preferred stock received as consideration for collaboration amendments	—	—	120,000
Receivables converted to preferred stock	—	3,385	—
Stock and warrants issued in business combinations	—	16,997	—
Stock issued to acquire noncontrolling interests	—	5,082	—
Stock issued for reacquired in-process research and development	159,323	—	—
Stock issued in asset acquisition	—	—	4,401
Long-term debt issued to a related party in an asset acquisition	30,000	—	—
Contingent consideration assumed in asset acquisition	—	—	3,660
Stock issued as payment for contingent consideration	—	—	1,583
Noncash dividend to shareholders	—	22,385	—
Purchases of property and equipment included in accounts payable and other accrued liabilities	2,267	2,257	652
Purchases of equipment financed through debt	234	—	—
Receivable recorded in anticipation of dissolution of affiliate	—	2,598	—
Transfer of inventory to breeding stock	—	—	1,191

The following table provides a reconciliation of the cash, cash equivalents, and restricted cash balances as of December 31, 2018 and 2017 as shown above:

	2018	2017
Cash and cash equivalents	$102,768	$68,111
Restricted cash	6,987	6,987
Restricted cash included in other assets	427	447
Cash, cash equivalents, and restricted cash	$110,182	$75,545

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

Table of Contents

Intrexon Corporation and Subsidiaries
Notes to the Consolidated Financial Statements
(Amounts in thousands, except share and per share data)

1. Organization and Basis of Presentation

Intrexon Corporation ("Intrexon"), a Virginia corporation, uses synthetic biology to focus on programming biological systems to alleviate disease, remediate environmental challenges, and provide sustainable food and industrial chemicals, which may be accomplished directly or through collaborations and joint ventures. Intrexon's primary domestic operations are in California, Florida, Maryland, and Virginia, and its primary international operations are in Hungary. There have been no commercialized products derived from Intrexon's collaborations to date.

Precigen, Inc. ("Precigen"), a dedicated discovery and clinical stage biopharmaceutical company advancing the next generation of gene and cellular therapies using precision technology to target urgent and intractable diseases in immuno-oncology, autoimmune disorders, and infectious diseases, is a wholly owned subsidiary of Intrexon with primary operations in Maryland.

ActoBio Therapeutics, Inc. ("ActoBio") is pioneering a new class of microbe-based biopharmaceuticals that enable expression and local delivery of disease-modifying therapeutics and is a wholly owned subsidiary of Intrexon with primary operations in Belgium.

Trans Ova Genetics, L.C. ("Trans Ova"), and Progentus, L.C. ("Progentus"), providers of advanced reproductive technologies, including services and products sold to cattle breeders and other producers, are wholly owned subsidiaries with primary operations in Iowa, Maryland, Missouri, New York, Oklahoma, and Texas. ViaGen, L.C. ("ViaGen"), a provider of genetic preservation and cloning technologies, is a wholly owned subsidiary of Trans Ova with primary operations in Iowa.

Oxitec Limited ("Oxitec"), a pioneering company in biological insect control solutions, is a wholly owned subsidiary of Intrexon with primary operations in England and Brazil.

Intrexon Produce Holdings, Inc. ("IPHI") is a wholly owned subsidiary of Intrexon. Okanagan Specialty Fruits, Inc. ("Okanagan"), a company that developed and received regulatory approval for the world's first non-browning apple without the use of any artificial additives, is a wholly owned subsidiary of IPHI with primary operations in Canada. Fruit Orchard Holdings, Inc. ("FOHI") is a wholly owned subsidiary of IPHI with primary operations in Washington.

Exemplar Genetics, LLC ("Exemplar") is a provider of genetically engineered swine for medical and genetic research and a wholly owned subsidiary with primary operations in Iowa.

As of December 31, 2018, Intrexon owned approximately 55% of AquaBounty Technologies, Inc. ("AquaBounty"), a company focused on improving productivity in commercial aquaculture, and whose common stock is listed on the NASDAQ Stock Market. See Note 14 for additional discussion.

Intrexon Corporation and its consolidated subsidiaries are hereinafter referred to as the "Company."

These consolidated financial statements are presented in United States dollars and are prepared under accounting principles generally accepted in the United States of America ("U.S. GAAP").

Liquidity and Going Concern

The Company has incurred operating losses since its inception and management expects operating losses and negative cash flows to continue for the foreseeable future and, as a result, the Company will require additional capital to fund its operations and execute its business plan. As of December 31, 2018, the Company had $222,456 in cash, cash equivalents and short-term investments which is not sufficient to fund the Company's planned operations through one year after the date the consolidated financial statements are issued and accordingly, there is substantial doubt about the Company's ability to continue as a going concern. The analysis used to determine the Company's ability to continue as a going concern does not include cash sources outside of the Company's direct control that management expects to be available within the next twelve months.

The Company may not be able to obtain sufficient additional funding through monetizing certain of its existing assets, entering into new license and collaboration agreements, issuing additional equity or debt instruments or any other means, and if it is able to do so, they may not be on satisfactory terms. The Company's ability to raise additional capital in the equity and debt markets, should the Company choose to do so, is dependent on a number of factors, including, but not limited to, the market demand for

Table of Contents

the Company's common stock, which itself is subject to a number of business risks and uncertainties, as well as the uncertainty that the Company would be able to raise such additional capital at a price or on terms that are favorable to the Company. Should the Company not be able to secure additional funding though these means, the Company may have to engage in any or all of the following activities: (i) shift internal investments from subsidiaries and platforms whose potential for value creation is longer-term to near-term opportunities; (ii) sell certain of our operating subsidiaries to third parties; (iii) reduce operating expenditures for third-party contractors, including consultants, professional advisors and other vendors; and (iv) reduce or delay capital expenditures, including non-essential facility expansions, lab equipment, and information technology projects. These actions may have a material adverse impact on the Company's ability to achieve certain of its planned objectives. Even if the Company is able to source additional funding, it may be forced to significantly reduce its operations if its business prospects do not improve. If the Company is unable to source additional funding, it may be forced to shut down operations altogether. These consolidated financial statements have been prepared on a going concern basis and do not include any adjustments to the amounts and classification of assets and liabilities that may be necessary in the event the Company can no longer continue as a going concern.

2. Summary of Significant Accounting Policies

Principles of Consolidation

The accompanying consolidated financial statements reflect the operations of the Company and its subsidiaries. All intercompany accounts and transactions have been eliminated.

Revenue Recognition (For the Year Ended December 31, 2018)

Effective January 1, 2018, the Company applies Accounting Standards Codification ("ASC") Topic 606, Revenue from Contracts with Customers ("ASC 606"). Under ASC 606, the Company recognizes revenue when its customer obtains control of the promised goods or services, in an amount that reflects the consideration that the Company expects to receive in exchange for those goods or services. To determine revenue recognition for arrangements that are within the scope of ASC 606, the Company performs the following five steps: (i) identify the contract(s) with a customer, (ii) identify the promises and distinct performance obligations in the contract, (iii) determine the transaction price, (iv) allocate the transaction price to the performance obligations in the contract, and (v) recognize revenue when (or as) the Company satisfies the performance obligations.

Collaboration and licensing revenues

The Company generates collaboration and licensing revenues through the execution of agreements with collaborators (known as exclusive channel collaborations, "ECC" or "ECCs") and licensing agreements whereby the collaborators or the licensee obtain exclusive access to the Company's proprietary technologies for use in the research, development and commercialization of products and/or treatments in a contractually specified field of use. Generally, the terms of these agreements provide that the Company receives some or all of the following: (i) upfront payments upon consummation of the agreement; (ii) reimbursements for costs incurred by the Company for research and development and/or manufacturing efforts related to specific applications provided for in the agreement; (iii) milestone payments upon the achievement of specified development, regulatory and commercial activities; and (iv) royalties on sales of products arising from the collaboration or licensing agreement. The agreement typically continues in perpetuity unless terminated and each of the Company's collaborators retain a right to terminate the agreement upon providing the Company written notice a certain period of time prior to such termination, generally 90 days.

The Company's collaboration and licensing agreements typically contain multiple promises, including technology licenses, research and development services and in certain cases manufacturing services. The Company determines whether each of the promises is a distinct performance obligation. As the nature of the promises in the Company's collaboration and licensing agreements are highly integrated and interrelated, the Company typically combines most of its promises into a single performance obligation. Because the Company is performing research and development services during early-stage development, the services are integral to the utilization of the technology license. Therefore, the Company has determined that the technology license and research and development services are typically inseparable from each other during the performance period of its collaboration and licensing agreements. Contingent manufacturing services that may be provided under certain of the Company's agreements are considered to be a separate future contract and not part of the current collaboration or licensing agreement.

At contract inception, the Company determines the transaction price, including fixed consideration and any estimated amounts of variable consideration. The upfront payment received upon consummation of the agreement is fixed and nonrefundable.

Table of Contents

Variable consideration is subject to a constraint and amounts are included in the transaction price to the extent that it is probable that a significant reversal in the amount of cumulative revenue recognized will not occur when the uncertainty associated with the variable consideration is subsequently resolved. Variable consideration may include reimbursements for costs incurred by the Company for research and development efforts; milestone payments upon the achievement of certain development, regulatory and commercial activities; and royalties on sales of products arising from the collaboration or licensing agreement. The Company determines the initial transaction price and excludes variable consideration that is otherwise constrained pursuant to the guidance in ASC 606.

The transaction price is allocated to the performance obligations in the agreement based on the standalone selling price of each performance obligation. The Company typically groups the promises in its collaboration and licensing agreements into one performance obligation so the entire transaction price relates to this single performance obligation. The technology license included in the single performance obligation is considered a functional license. However, it is typically combined into a single performance obligation as the Company provides interrelated research and development services along with other obligations over an estimated period of performance. The Company utilizes judgment to determine the most appropriate method to measure its progress of performance under the agreement, primarily based on inputs necessary to fulfill the performance obligation. The Company evaluates its measure of progress to recognize revenue each reporting period and, if necessary, adjusts the measure of performance and related revenue recognition. The Company's measure of performance and revenue recognition involves significant judgment and assumptions, including, but not limited to, estimated costs and timelines to complete its performance obligations. The Company evaluates modifications and amendments to its contracts to determine whether any changes should be accounted for prospectively or on a cumulative catch-up basis.

Payments received for cost reimbursements for research and development efforts are recognized as revenue as the services are performed, in connection with the single performance obligation discussed above. The reimbursements relate specifically to the Company's efforts to provide services and the reimbursements are consistent with what the Company would typically charge other collaborators for similar services.

The Company assesses the uncertainty of when and if the milestone will be achieved to determine whether the milestone is included in the transaction price. The Company then assesses whether the revenue is constrained based on whether it is probable that a significant reversal of revenue would not occur when the uncertainty is resolved.

Royalties, including sales-based milestones, received under the agreements will be recognized as revenue when sales have occurred because the Company applies the sales- or usage-based royalties recognition exception provided for under ASC 606. The Company determined the application of this exception is appropriate because at the time the royalties are generated, the technology license granted in the agreement is the predominant item to which the royalties relate.

As the Company receives upfront payments in its collaboration and licensing agreements, it evaluates whether any significant financing components exist in its collaboration and licensing agreements. Based on the nature of its collaboration and licensing agreements, there are no significant financing components as the purpose of the upfront payment is not to provide financing. The purpose is to provide the collaborator with assurance that the Company will complete its obligations under the contract or to secure the right to a specific product or service at the collaborator's discretion. In addition, the variable payments generally align with the timing of performance or the timing of the consideration varies on the basis of the occurrence or nonoccurrence of a future event that is not substantially within the control of the collaborator or the Company.

From time to time, the Company and certain collaborators may cancel their agreements, relieving the Company of any further performance obligations under the agreement. Upon such cancellation or when the Company has determined no further performance obligations are required of the Company under an agreement, the Company recognizes any remaining deferred revenue.

Product and service revenues

The Company generates product and service revenues primarily through sales of products and services that are created from technologies developed or owned by the Company. The Company's current offerings include sales of advanced reproductive technologies, including the Company's bovine embryo transfer and in vitro fertilization processes and from genetic preservation and sexed semen processes and applications of such processes to other livestock, as well as

sales of livestock and embryos produced using these processes and used in production. As each promised product or service is distinct, the Company recognizes the transaction price as revenue when control of the promised product is transferred to the customer or when the promised service is rendered. Payment terms are typically due within 30 days.

Table of Contents

Revenue Recognition (For the Years Ended December 31, 2017 and 2016)

Collaboration and licensing revenues

The Company generates collaboration and licensing revenue through collaboration and licensing agreements whereby the collaborators or the licensee obtain exclusive access to the Company's proprietary technologies for use in the research, development and commercialization of products and/or treatments in a contractually specified field of use. Generally, the terms of these agreements provide that the Company receives some or all of the following: (i) upfront payments upon consummation of the agreement, (ii) reimbursements for costs incurred by the Company for research and development and/or manufacturing efforts related to specific applications provided for in the agreement, (iii) milestone payments upon the achievement of specified development, regulatory and commercial activities, and (iv) royalties on sales of products arising from the collaboration or licensing agreement.

The Company's collaboration and licensing agreements typically contain multiple elements, or deliverables, including technology licenses, research and development services, and in certain cases manufacturing services. The Company identifies the deliverables within the agreements and evaluates which deliverables represent separate units of accounting. Analyzing the agreements to identify deliverables requires the use of judgment. A deliverable is considered a separate unit of accounting when the deliverable has value to the collaborator or licensee on a standalone basis based on the consideration of the relevant facts and circumstances for each agreement.

Consideration received is allocated at the inception of the agreement to all identified units of accounting based on their relative selling price. When available, the relative selling price for each deliverable is determined using vendor specific objective evidence ("VSOE") of the selling price or third-party evidence of the selling price, if VSOE does not exist. If neither VSOE nor third-party evidence of the selling price exists, the Company uses its best estimate of the selling price for the deliverable. The amount of allocable consideration is limited to amounts that are fixed or determinable. The consideration received is allocated among the separate units of accounting, and the applicable revenue recognition criteria are applied to each of the separate units. The Company recognizes the revenue allocated to each unit of accounting as the Company delivers the related goods or services. If the Company determines that certain deliverables should be treated as a single unit of accounting, then the revenue is recognized using either a proportional performance or straight-line method, depending on whether the Company can reasonably estimate the level of effort required to complete its performance obligations under an arrangement and whether such performance obligations are provided on a best-efforts basis. As the Company cannot reasonably estimate its performance obligations related to its collaborators or licensees, the Company recognizes revenue on a straight-line basis over the period it expects to complete its performance obligations, which is reevaluated each reporting period.

The terms of the Company's agreements may provide for milestone payments upon achievement of certain defined events. The Company applies the Milestone Method for recognizing milestone payments. Under the Milestone Method, the Company recognizes consideration that is contingent upon the achievement of a milestone in its entirety as revenue in the period in which the milestone is achieved only if the milestone is substantive in its entirety. A milestone is considered substantive when it meets all of the following criteria:

(1) The consideration is commensurate with either the entity's performance to achieve the milestone or the enhancement of the value of the delivered item or items as a result of a specific outcome resulting from the entity's performance to achieve the milestone;

(2) The consideration relates solely to past performance; and

(3) The consideration is reasonable relative to all of the deliverables and payment terms within the arrangement.

In the event that a milestone is not considered substantive, the Company recognizes the milestone consideration as revenue using the same method applied to upfront payments.

Research and development services are a deliverable satisfied by the Company in accordance with the terms of the collaboration and licensing agreements and the Company considers these services to be inseparable from the license to the core technology; therefore, reimbursements of services performed are recognized as revenue. Because reimbursement (i) is contingent upon performance of the services by the Company, (ii) does not include a profit component, and (iii) does not relate to any future deliverable, the revenue is recognized during the period in which the related services are performed and collection of such amounts is reasonably assured. Payments received for manufacturing services will be recognized when the earnings process related to the manufactured materials has been

completed. Royalties to be received under the agreements will be recognized as earned.

Table of Contents

From time to time, the Company and certain collaborators may cancel their agreements, relieving the Company of any further performance obligations under the agreement. When no further performance obligations are required of the Company under an agreement, the Company recognizes any remaining deferred revenue.

Product and service revenues

The Company generates product and service revenues primarily through sales of products and services that are created from technologies developed or owned by the Company. The Company's current offerings include sales of advanced reproductive technologies, including the Company's bovine embryo transfer and in vitro fertilization processes and from genetic preservation and sexed semen processes and applications of such processes to other livestock, as well as sales of livestock and embryos produced using these processes and used in production. Revenue is recognized when (i) persuasive evidence of an arrangement exists, (ii) services have been rendered or delivery has occurred such that risk of loss has passed to the customer, (iii) the price is fixed or determinable, and (iv) collection from the customer is reasonably assured.

Research and Development

The Company considers that regulatory requirements inherent in the research and development of new products preclude it from capitalizing such costs. Research and development expenses include salaries and related costs of research and development personnel, including stock-based compensation expense, costs to acquire or reacquire technology rights, consultants, facilities, materials and supplies associated with research and development projects as well as various laboratory studies. Costs incurred in conjunction with collaboration and licensing arrangements are included in research and development. Indirect research and development costs include depreciation, amortization and other indirect overhead expenses.

The Company has research and development arrangements with third parties that include upfront and milestone payments. As of December 31, 2018 and 2017, the Company had research and development commitments with third parties that had not yet been incurred totaling $11,853 and $10,682, respectively. The commitments are generally cancellable by the Company at any time upon written notice.

Cash and Cash Equivalents

All highly liquid investments with an original maturity of three months or less at the date of purchase are considered to be cash equivalents. Cash balances at a limited number of banks may periodically exceed insurable amounts. The Company believes that it mitigates its risk by investing in or through major financial institutions. Recoverability of investments is dependent upon the performance of the issuer. As of December 31, 2018 and 2017, the Company had cash equivalent investments in highly liquid money market accounts at major financial institutions of $40,155 and $43,012, respectively.

Restricted Cash

Restricted cash represents funds deposited with the United States Treasury, as required by a court decision resulting from litigation against Trans Ova (Note 16).

Short-term and Long-term Investments

As of December 31, 2018, short-term investments include United States government debt securities and certificates of deposit. The Company determines the appropriate classification as short-term or long-term at the time of purchase based on original maturities and management's reasonable expectation of sales and redemption. The Company reevaluates such classification at each balance sheet date. The Company's written investment policy requires investments to be explicitly rated by two of Standard & Poor's, Moody's or Fitch and to have a minimum rating of A1, P1 or F-1, respectively, from those agencies. In addition, the investment policy limits the amount of credit exposure to any one issuer.

Equity Securities

The Company holds equity securities received and/or purchased from certain collaborators. Other than investments accounted for using the equity method, the Company elected the fair value option to account for its equity securities held in these collaborators. These equity securities are recorded at fair value at each reporting date and are subject to market price volatility. Unrealized gains and losses resulting from fair value adjustments are reported in the consolidated statements of operations. The fair value of these equity securities is subject to fluctuation in the future due to the volatility of the stock market, changes in general economic conditions and changes in the financial

conditions of these collaborators. Equity securities that the Company does not intend to sell within one year are classified as noncurrent in the consolidated balance sheet.

Table of Contents

The Company records the fair value of securities received on the date the collaboration is consummated or the milestone is achieved using the closing, quoted price of the collaborator's security on that date, assuming the transfer of consideration is considered perfunctory. If the transfer of the consideration is not considered perfunctory, the Company considers the specific facts and circumstances to determine the appropriate date on which to evaluate fair value. The Company also evaluates whether any discounts for trading restrictions or other basis for lack of marketability should be applied to the fair value of the securities at inception of the collaboration. In the event the Company concludes that a discount should be applied, the fair value of the securities is adjusted at inception of the collaboration and re-evaluated at each reporting period thereafter.

Investments in Preferred Stock

The Company holds preferred stock in certain of its collaborators, most of which may be converted to common stock as described in Note 7. The Company elected the fair value option to account for its investments in preferred stock whereby the value of preferred stock is adjusted to fair value as of each reporting date and unrealized gains and losses are reported in the consolidated statements of operations. These investments are subject to fluctuation in the future due to, among other things, the likelihood and timing of conversion of certain of the preferred stock into common stock, the volatility of each collaborator's common stock, and changes in general economic and financial conditions of the collaborators. The investments are classified as noncurrent in the consolidated balance sheet since the Company does not intend to sell the investments nor expect the investments that are convertible into common stock to be converted within one year.

The Company is entitled to monthly dividends and records dividend income as described in Note 7.

Fair Value of Financial Instruments

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. As such, fair value is a market-based measurement that should be determined based on assumptions that market participants would use in pricing an asset and liability. As a basis for considering such assumptions, the Company uses a three-tier fair value hierarchy that prioritizes the inputs used in its fair value measurements. The hierarchy gives the highest priority to unadjusted quoted prices in active markets for identical assets or liabilities (Level 1 measurements) and the lowest priority to unobservable inputs (Level 3 measurements). The three levels of the fair value hierarchy are as follows:

Level 1: Quoted prices in active markets for identical assets and liabilities;

Level 2: Other than quoted prices included in Level 1 inputs that are observable for the asset or liability, either directly or indirectly; and

Level 3: Unobservable inputs for the asset or liability used to measure fair value to the extent that observable inputs are not available.

Concentrations of Risk

Due to the Company's mix of fixed and variable rate securities holdings, the Company's investment portfolio is susceptible to changes in interest rates. As of December 31, 2018, gross unrealized losses on the Company's short-term investments were not material. From time to time, the Company may liquidate some or all of its investments to fund operational needs or other activities, such as capital expenditures or business acquisitions, or distribute its equity securities to shareholders as a stock dividend. Depending on which investments the Company liquidates to fund these activities, the Company could recognize a portion, or all, of the gross unrealized losses.

Financial instruments that potentially subject the Company to concentrations of credit risk consist primarily of trade and related party receivables. The Company controls credit risk through credit approvals, credit limits and monitoring procedures. The Company performs ongoing credit evaluations of its customers but generally does not require collateral to support accounts receivable.

Equity Method Investments

The Company accounts for its investments in each of its joint ventures and for its investments in start-up entities backed by the Harvest Intrexon Enterprise Fund I, LP ("Harvest"), a related party, (Note 17) using the equity method of accounting based upon relative ownership interest. The Company's investments in these entities are included in

investments in affiliates in the

Table of Contents

accompanying consolidated balance sheets. See additional discussion related to certain of the Harvest start-up entities in Note 3.

The Company accounts for its investment in Oragenics, Inc. ("Oragenics"), one of its collaborators and a related party, using the fair value option. Oragenics was considered an equity method investment until September 30, 2018, by which point the Company's ownership level had significantly decreased. See Note 7 for additional discussion regarding Oragenics. The Company's ownership of Oragenics was 29.4% as of December 31, 2017, and the fair value of the Company's investment was $3,085 as of that date, which is included as equity securities, noncurrent, in the accompanying consolidated balance sheet. Unrealized depreciation in the fair value of these securities was $4,159 and $10,523 for the years ended December 31, 2017 and 2016, respectively.

Summarized financial data as of December 31, 2018 and 2017, and for the years ended December 31, 2018, 2017, and 2016, for the Company's equity method investments are shown in the following tables.

	December 31,	
	2018	2017
Current assets	$17,485	$61,086
Noncurrent assets	31,274	13,598
Total assets	48,759	74,684
Current liabilities	4,226	6,213
Net assets	$44,533	$68,471

	Year Ended December 31,		
	2018	2017	2016
Revenues	$557	$254	$417
Operating expenses	36,990	41,904	62,373
Operating loss	(36,433)	(41,650)	(61,956)
Other, net	44	(8)	1,535
Net loss	$(36,389)	$(41,658)	$(60,421)

Variable Interest Entities

The Company identifies entities that (i) do not have sufficient equity investment at risk to permit the entity to finance its activities without additional subordinated financial support or (ii) in which the equity investors lack an essential characteristic of a controlling financial interest as variable interest entities ("VIE" or "VIEs"). The Company performs an initial and on-going evaluation of the entities with which the Company has variable interests to determine if any of these entities are VIEs. If an entity is identified as a VIE, the Company performs an assessment to determine whether the Company has both (i) the power to direct activities that most significantly impact the VIE's economic performance and (ii) have the obligation to absorb losses from or the right to receive benefits of the VIE that could potentially be significant to the VIE. If both of these criteria are satisfied, the Company is identified as the primary beneficiary of the VIE.

As of December 31, 2018 and 2017, the Company determined that certain of its collaborators and joint ventures as well as Harvest were VIEs. The Company was not the primary beneficiary for these entities since it did not have the power to direct the activities that most significantly impact the economic performance of the VIEs. The Company's aggregate investment balances of these VIEs as of December 31, 2018 and 2017, were $21,219 and $185,261, respectively, which represents the Company's maximum risk of loss related to the identified VIEs.

Trade Receivables

Trade receivables consist of credit extended to the Company's customers in the normal course of business and are reported net of an allowance for doubtful accounts. The Company reviews its customer accounts on a periodic basis and records bad debt expense for specific amounts the Company evaluates as uncollectible. Past due status is determined based upon contractual terms. Amounts are written off at the point when collection attempts have been exhausted. Management estimates uncollectible amounts considering such factors as current economic conditions and historic and anticipated customer performance. This estimate can fluctuate due to changes in economic, industry or specific customer conditions that may require adjustment to the

F-21

Table of Contents

allowance recorded by the Company. Management has included amounts believed to be uncollectible in the allowance for doubtful accounts.

The following table shows the activity in the allowance for doubtful receivable accounts for the years ended December 31, 2018, 2017, and 2016:

	2018	2017	2016
Beginning balance	$4,631	$3,703	$2,081
Charged to operating expenses	1,779	1,217	1,963
Write offs of accounts receivable, net of recoveries	(1,267)	(289)	(341)
Ending balance	$5,143	$4,631	$3,703

Inventory

The Company's inventory primarily includes adult female cows that are used in certain production processes and are recorded at acquisition cost using the first-in, first-out method or net realizable value, whichever is lower.

Work-in-process inventory includes allocations of production costs and facility costs for products currently in production and is recorded at the lower of cost or net realizable value. Significant declines in the price of cows could result in unfavorable adjustments to inventory balances.

Property, Plant and Equipment

Property, plant and equipment are stated at cost, less accumulated depreciation and amortization. Major additions or betterments are capitalized and repairs and maintenance are generally expensed as incurred. Depreciation and amortization is calculated using the straight-line method over the estimated useful lives of the assets. The estimated useful lives of these assets are as follows:

	Years
Land improvements	4–20
Buildings and building improvements	3–25
Furniture and fixtures	1–10
Equipment	1–10
Breeding stock	1–4
Computer hardware and software	1–7

Leasehold improvements are amortized over the shorter of the useful life of the asset or the applicable lease term, generally one to twenty years.

Goodwill

Goodwill represents the future economic benefits arising from other assets acquired in a business combination that are not individually identified and separately recognized. Goodwill is reviewed for impairment at least annually. The Company performs a qualitative assessment to determine whether it is more-likely-than-not that the fair value of a reporting unit is less than its carrying amount prior to performing the goodwill impairment test. If this is the case, the goodwill impairment test is required. If it is more-likely-than-not that the fair value of a reporting unit is greater than the carrying amount, the goodwill impairment test is not required.

If the goodwill impairment test is required, first, the fair value of the reporting unit is compared with its carrying amount (including goodwill). If the fair value of the reporting unit is less than its carrying amount, an indication of goodwill impairment exists for the reporting unit and the entity must record the impairment charge for the excess carrying amount, which is limited to the amount of goodwill allocated to the reporting unit. If the fair value of the reporting unit exceeds its carrying amount, no goodwill impairment charge is necessary.

The Company performs its annual impairment review of goodwill in the fourth quarter, or sooner if a triggering event occurs prior to the annual impairment review. In the fourth quarter of 2018, the Company concluded that Precigen and ActoBio are

Table of Contents

now separate reporting units. Accordingly, the Company performed a relative fair value allocation of certain of its goodwill, as well as an impairment review of the reallocated goodwill. See Note 11 for additional discussion regarding the results of this review for the year ended December 31, 2017, which resulted in a goodwill impairment charge.

Intangible Assets

Intangible assets subject to amortization consist of patents, developed technologies and know-how; customer relationships; and trademarks acquired as a result of mergers and acquisitions. These intangible assets are subject to amortization, were recorded at fair value at the date of acquisition and are stated net of accumulated amortization. Indefinite-lived intangible assets consist of in-process research and development technologies acquired in mergers or acquisitions and were recorded at fair value at the dates of the respective acquisitions.

The Company amortizes long-lived intangible assets to reflect the pattern in which the economic benefits of the intangible asset are expected to be realized. The intangible assets are amortized over their estimated useful lives, ranging from three to twenty-one years for the patents, developed technologies and know-how; customer relationships; and trademarks.

Impairment of Long-Lived Assets

Long-lived assets to be held and used, including property, plant and equipment and intangible assets subject to amortization, are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of the assets may not be recoverable. Conditions that would necessitate an impairment assessment include a significant decline in the observable market value of an asset, a significant change in the extent or manner in which an asset is used, or a significant adverse change that would indicate that the carrying amount of an asset or group of assets is not recoverable.

Indefinite-lived intangible assets, including in-process research and development, are tested for impairment annually, or more frequently if events or circumstances between annual tests indicate that the asset may be impaired. Impairment losses on indefinite-lived intangible assets are recognized based solely on a comparison of their fair value to carrying value, without consideration of any recoverability test. The Company monitors the progression of its in-process research and development, as the likelihood of success is contingent upon commercial development or regulatory approval.

See Note 11 for additional discussion of impairment of long-lived assets for the years ended December 31, 2018 and 2017.

Convertible Notes

The Company allocated the proceeds received in July 2018 from the issuance of Intrexon's 3.50% convertible senior notes due 2023 (the "Convertible Notes") between long-term debt (liability component) and additional paid-in capital (equity component) within the consolidated balance sheet. The original value assigned to long-term debt is the estimated fair value as of the issuance date of a similar debt instrument without a conversion option. The original value assigned to additional paid-in capital represents the value of the conversion option and is calculated by deducting the fair value of the long-term debt from the principal amount of the Convertible Notes and is not remeasured as long as it continues to meet the requirements for equity classification. The original value of the conversion option will accrete to the carrying value of the long-term debt and result in additional noncash interest expense over the expected life of the Convertible Notes using the effective interest method.

Debt issuance costs related to the Convertible Notes are also allocated between long-term debt and additional paid-in capital based on the original value assigned to each. Debt issuance costs allocated to long-term debt reduced the original carrying value and will accrete to the carrying value of the long-term debt and result in additional noncash interest expense over the expected life of the Convertible Notes using the effective interest method. Debt issuance costs allocated to additional paid-in capital are recorded as reduction of the original value assigned to the conversion option.

See Note 12 for the further discussion of the Convertible Notes.

Foreign Currency Translation

The assets and liabilities of foreign subsidiaries, where the local currency is the functional currency, are translated from their respective functional currencies into United States dollars at the exchange rates in effect at the balance sheet date, with resulting foreign currency translation adjustments recorded in the consolidated statement of

comprehensive loss. Revenue and expense amounts are translated at average rates during the period.

Table of Contents

Income Taxes

Income taxes are accounted for under the asset and liability method. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to both differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases as well as operating loss and tax credit carryforwards. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in income in the period that includes the enactment date of the change. Valuation allowances are established when necessary to reduce deferred tax assets to the amount expected to be realized.

The Company identifies any uncertain income tax positions and recognizes the effect of income tax positions only if those positions are more likely than not of being sustained. Recognized income tax positions are measured at the largest amount that is greater than 50% likely of being realized. Changes in recognition or measurement are reflected in the period in which the change in judgment occurs. The Company records interest, if any, related to unrecognized tax benefits as a component of interest expense. Penalties, if any, are recorded in selling, general and administrative expenses.

On December 22, 2017, the Tax Cuts and Jobs Act of 2017 (the "Tax Act") was signed into law and significantly revised United States corporate income tax law by, among other things, reducing the corporate income tax rate to 21% effective January 1, 2018, eliminating the corporate alternative minimum tax and implementing a modified territorial tax system that includes a one-time transition tax on deemed repatriated earnings from foreign subsidiaries. The United States Securities and Exchange Commission ("SEC") Staff issued Staff Accounting Bulletin No. 118 ("SAB 118") to address the application of U.S. GAAP in situations when a registrant does not have the necessary information available, prepared, or analyzed, including computations, in reasonable detail to complete the accounting for certain income tax effects of the Tax Act. The Company recognized provisional tax impacts related to revaluation of most of the Company's domestic deferred tax assets, the impact of revaluation of those deferred tax assets on the Company's valuation allowance and elimination of the corporate alternative minimum tax, and included those amounts in the consolidated financial statements for the year ended December 31, 2017. The Company completed its accounting for the Tax Act in the fourth quarter of 2018, and there were no significant adjustments to the previously recorded provisional amounts.

In addition, the Tax Act implemented a new minimum tax on global intangible low-taxed income ("GILTI"). A company can elect an accounting policy to account for GILTI in either of the following ways:

- As a period charge in the future period in which the tax arises; or
- As part of deferred taxes related to the investment or subsidiary.

The Company elected to account for GILTI as a period charge in the period in which the tax arises. There was no impact to the accompanying consolidated financial statements as of and for the year ended December 31, 2018. See Note 13 for additional discussion of the Tax Act.

Share-Based Payments

Intrexon uses the Black-Scholes option pricing model to estimate the grant-date fair value of all stock options. The Black-Scholes option pricing model requires the use of assumptions for estimated expected volatility, estimated expected term of stock options, risk-free rate, estimated expected dividend yield, and the fair value of the underlying common stock at the date of grant. Since Intrexon does not have sufficient history to estimate the expected volatility of its common stock price, expected volatility is based on a blended approach that utilizes the volatility of Intrexon's common stock and the volatility of peer public entities that are similar in size and industry. Intrexon estimates the expected term of all options based on previous history of exercises. The risk-free rate is based on the United States Treasury yield curve in effect at the time of grant for the expected term of the option. The expected dividend yield is 0% as Intrexon does not expect to declare cash dividends in the near future. The fair value of the underlying common stock is determined based on the quoted market price on the Nasdaq Global Select Market ("NASDAQ"). Forfeitures are recorded when incurred. The assumptions used in the Black-Scholes option pricing model for the years ended December 31, 2018, 2017 and 2016 are set forth in the table below:

Table of Contents

	2018	2017	2016
Valuation assumptions			
Expected dividend yield	0%	0%	0%
Expected volatility	55%—59%	57%—60%	59%—60%
Expected term (years)	6.25	6.25	6.25
Risk-free interest rate	2.33%—3.06%	1.89%—2.27%	1.23%—2.17%

Grant date fair value for the Company's restricted stock units ("RSUs") is based on the fair value of the underlying common stock as determined based on the quoted market price on the NASDAQ on the date of grant.

Net Loss per Share

Basic net loss per share is calculated by dividing net loss attributable to common shareholders by the weighted average shares outstanding during the period, without consideration of common stock equivalents. Diluted net loss per share is calculated by adjusting weighted average shares outstanding for the dilutive effect of common stock equivalents outstanding for the period, using the treasury-stock method. For purposes of the diluted net loss per share calculation, shares to be issued pursuant to convertible debt, stock options, RSUs, and warrants are considered to be common stock equivalents but are excluded from the calculation of diluted net loss per share because their effect would be anti-dilutive and, therefore, basic and diluted net loss per share were the same for all periods presented.

Segment Information

While the Company generates revenues from multiple sources, including collaboration agreements, licensing, and products and services primarily associated with bovine reproduction, management is organized around a singular research and development focus to further the development of the Company's underlying synthetic biology technologies. Accordingly, the Company has determined that it operates in one segment. As of December 31, 2018 and 2017, the Company had $16,839 and $21,837, respectively, of long-lived assets in foreign countries. The Company recognized revenues derived in foreign countries totaling $11,945, $17,605, and $11,969 for the years ended December 31, 2018, 2017 and 2016, respectively.

Use of Estimates

The preparation of financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities at the date of the financial statements, and the reported amounts of revenues and expenses during the reporting periods. Actual results could differ from those estimates.

Recently Adopted Accounting Pronouncements

The Company adopted ASC 606 for open contracts on January 1, 2018 using the modified retrospective approach. As a result of the adoption of ASC 606, including guidance on contract modifications, the Company recognized a cumulative catch-up adjustment to decrease deferred revenue in the net amount of $26,507 and accumulated deficit in the net amount of $26,611 and to increase accumulated other comprehensive loss in the net amount of $104.

Table of Contents

In accordance with ASC 606, the disclosure of the impacted line items upon adoption of ASC 606 on the Company's consolidated statement of operations for the year ended December 31, 2018 and consolidated balance sheet as of December 31, 2018 was as follows:

	Year Ended December 31, 2018		
	As Reported	Balances Without Adoption of ASC 606	Effect of Change
Consolidated Statement of Operations			
Collaboration and licensing revenues	$76,869	$78,441	$(1,572)
Net loss	(514,706)	(513,134)	(1,572)
Net loss attributable to Intrexon	(509,336)	(507,764)	(1,572)

	December 31, 2018		
	As Reported	Balances Without Adoption of ASC 606	Effect of Change
Consolidated Balance Sheet			
Liabilities			
Deferred revenue, current	$15,554	$18,934	$(3,380)
Deferred revenue, net of current portion	54,210	48,082	6,128
Total equity			
Accumulated deficit	(1,330,545)	(1,355,583)	25,038
Accumulated other comprehensive loss	(28,612)	(28,598)	(14)

In February 2018, the Financial Accounting Standards Board ("FASB") issued Accounting Standards Update ("ASU") 2018-02, Income Statement-Reporting Comprehensive Income (Topic 220): Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income ("ASU 2018-02"). The provisions of ASU 2018-02 allow a reclassification from accumulated other comprehensive income to retained earnings for stranded tax effects resulting from the Tax Act. The amendments in ASU 2018-02 may be applied either in the period of adoption or retrospectively to each period (or periods) in which the effect of the change in the United States federal corporate income tax rate in the Tax Act is recognized. The Company adopted this provision in 2018, and there was no material impact to the accompanying financial statements.

In May 2017, the FASB issued ASU 2017-09, Compensation-Stock Compensation (Topic 718) – Scope of Modification Accounting ("ASU 2017-09"). The provisions of ASU 2017-09 provide guidance about which changes to the terms or conditions of a share-based payment award require an entity to apply modification accounting in ASC Topic 718 ("ASC 718"). An entity should account for the effects of a modification unless (a) the fair value of the modified award is the same as the fair value of the original award, (b) the vesting conditions of the modified award are the same as the vesting conditions of the original award and (c) the classification of the modified award as an equity instrument or a liability instrument is the same as the classification of the original award immediately before the original award is modified. The Company adopted this standard effective January 1, 2018, and will apply this guidance to future modifications.

In November 2016, the FASB issued ASU 2016-18, Statement of Cash Flows (Topic 230) - Restricted Cash (A Consensus of the FASB Emerging Issues Task Force) ("ASU 2016-18"). The provisions of ASU 2016-18 require amounts generally described as restricted cash and restricted cash equivalents to be included with cash and cash equivalents when reconciling the total beginning and ending balances for the periods presented on the statement of cash flows. The Company adopted this standard effective January 1, 2018. In accordance with the provisions of ASU

2016-18, net cash used in operating activities decreased by $6,987 and the "Cash, cash equivalents, and restricted cash" ending period balance increased by $6,987 for the year ended December 31, 2016 in the accompanying consolidated statement of cash flows. The beginning and ending period balances increased by $6,987 and $7,434, respectively; net cash used in operating activities decreased by $419; and the effect of exchange rate changes on cash, cash equivalents, and restricted cash increased by $28 in the accompanying consolidated statement of cash flows for the year ended December 31, 2017 from what was previously reported in the Company's Annual Report for the period ended December 31, 2017.

Table of Contents

In October 2016, the FASB issued ASU 2016-16, Income Taxes (Topic 740) - Intra-Entity Transfers of Assets Other Than Inventory ("ASU 2016-16"). The provisions of ASU 2016-16 remove the prohibition in ASC Topic 740 against the immediate recognition of the current and deferred income tax effects of intra-entity transfers of assets other than inventory. The Company adopted this standard effective January 1, 2018, and the implementation of this standard did not have a material impact on the Company's consolidated financial statements.

In August 2016, the FASB issued ASU 2016-15, Statement of Cash Flows (Topic 230) - Classification of Certain Cash Receipts and Cash Payments ("ASU 2016-15"). The provisions of ASU 2016-15 address eight specific cash flow issues and how those certain cash receipts and cash payments are presented and classified in the statement of cash flows under ASC Topic 230 and other Topics. The Company adopted this standard effective January 1, 2018, and the implementation of this standard did not have a material impact on the Company's consolidated financial statements.

In January 2016, the FASB issued ASU 2016-01, Financial Instruments - Overall (Subtopic 825-10) - Recognition and Measurement of Financial Assets and Financial Liabilities ("ASU 2016-01"). The provisions of ASU 2016-01 make targeted improvements to enhance the reporting model for financial instruments to provide users of financial statements with more decision-useful information, including certain aspects of recognition, measurement, presentation, and disclosure of financial instruments. In February 2018, the FASB issued ASU 2018-03, Technical Corrections and Improvements to Financial Instruments-Overall (Subtopic 825-10): Recognition and Measurement of Financial Assets and Financial Liabilities, to clarify certain aspects of the guidance issued in ASU 2016-01. The Company adopted this standard effective January 1, 2018, and the implementation of this standard did not have a material impact on the Company's consolidated financial statements.

Recently Issued Accounting Pronouncements

In February 2016, the FASB issued ASU 2016-02, Leases (Topic 842) ("ASU 2016-02"). The provisions of ASU 2016-02 set out the principles for the recognition, measurement, presentation and disclosure of leases for both parties to a contract (i.e. lessees and lessors). The new standard requires lessees to apply a dual approach, classifying leases as either finance or operating leases based on the principle of whether or not the lease is effectively a financed purchase by the lessee. This classification will determine whether lease expense is recognized based on an effective interest method or on a straight-line basis over the term of the lease, respectively. A lessee is also required to record a right-of-use ("ROU") asset and a lease liability for all leases with a term of greater than 12 months regardless of their classification. Leases with a term of 12 months or less will be accounted for in a similar manner as under existing guidance for operating leases today. ASU 2016-02 supersedes the previous lease standard, ASC Topic 840 ("ASC 840"), Leases. In July 2018, the FASB issued ASU 2018-10, Codification Improvements to Topic 842 (Leases), and ASU 2018-11, Leases (Topic 842), Targeted Improvements ("ASU 2018-11"), which provide (i) narrow amendments to clarify how to apply certain aspects of the new lease standard, (ii) entities with an additional transition method to adopt the new standard, and (ii) lessors with a practical expedient for separating components of a contract. ASU 2018-11 specifically permits an entity to elect an additional transition method to the existing modified retrospective transition requirements. Under the new transition method, an entity could adopt the provisions of ASU No. 2016-02 by recognizing a cumulative-effect adjustment to the opening balance of retained earnings in the period of adoption without adjustment to the financial statements for periods prior to adoption. Consequently, an entity's reporting for the comparative periods presented in the financial statements in which it adopts the new leases standard will continue to be in accordance with the previous lease guidance in ASC 840. ASU No. 2018-11 also allows a practical expedient that permits lessors to not separate non-lease components from the associated lease component if certain conditions are present. All of these ASUs related to ASC Topic 842 are effective for annual periods and interim periods within those annual periods beginning after December 15, 2018, and is effective for the Company for the year ending December 31, 2019. The Company is adopting ASU 2016-02 using the modified retrospective method, upon its effective date of January 1, 2019. The Company is electing the package of practical expedients permitted under the transition guidance within the new standard, which among other things, allows the Company to carryforward the historical lease classification for all leases in effect at adoption. The Company will make an accounting policy election to keep leases with an initial term of 12 months or less off of the consolidated balance sheet and will recognize those lease payments in the consolidated statements of operations on a straight-line basis over the lease term. Upon adoption of ASU 2016-02, the Company expects to recognize ROU assets and lease liabilities for operating leases within a

range of $42,000 to $47,000.

In October 2018, the FASB issued ASU 2018-18, Collaborative Arrangements (Topic 808): Clarifying the Interaction between Topic 808 and Topic 606 ("ASU 2018-18"). The provisions of ASU 2018-18 clarify when certain transactions between collaborative arrangement participants should be accounted for under ASC 606 and incorporates unit-of-account guidance consistent with ASC 606 to aid in this determination. The guidance is effective for annual periods and interim periods within those annual periods beginning after December 15, 2019, with early adoption permitted, and is effective for the Company for the year ending December 31, 2020. The Company is currently evaluating the impact that the implementation of this standard will have on the Company's consolidated financial statements.

Table of Contents

In October 2018, the FASB issued ASU 2018-17, Consolidation (Topic 810): Targeted Improvements to Related Party Guidance for Variable Interest Entities ("ASU 2018-17"). The provisions of ASU 2018-17 modify the guidance under ASC Topic 810 related to the evaluation of indirect interests held through related parties under common control when determining whether fees paid to decision makers and service providers are variable interests. Indirect interests held through related parties that are under common control are no longer considered to be the equivalent of direct interests in their entirety and instead should be considered on a proportional basis. This guidance more closely aligns with accounting of how indirect interests held through related parties under common control are considered for determining whether a reporting entity must consolidate a VIE. The guidance is effective for annual periods and interim periods within those annual periods beginning after December 15, 2019, with early adoption permitted, and is effective for the Company for the year ending December 31, 2020. The Company is currently evaluating the impact that the implementation of this standard will have on the Company's consolidated financial statements.

In August 2018, the FASB issued ASU 2018-15, Intangibles-Goodwill and Other-Internal-Use Software (Subtopic 350-40): Customer's Accounting for Implementation Costs Incurred in a Cloud Computing Arrangement That Is a Service Contract ("ASU 2018-15"). The provisions of ASU 2018-15 clarify the accounting for implementation costs of a hosting arrangement that is a service contract. The new standard requires an entity (customer) in a hosting arrangement that is a service contract to follow existing internal-use software guidance to determine which implementation costs to capitalize as an asset related to the service contract and which costs to expense. Capitalized implementation costs of a hosting arrangement that is a service contract should be amortized over the term of the hosting arrangement, which might extend beyond the noncancelable period if there are options to extend or terminate. ASU 2018-15 also specifies the financial statement presentation of capitalized implementation costs and related amortization, in addition to required disclosures for material capitalized implementation costs related to hosting arrangements that are service contracts. The guidance is effective for annual periods and interim periods within those annual periods beginning after December 15, 2019, with early adoption permitted, and is effective for the Company for the year ending December 31, 2020. The Company is currently evaluating the impact that the implementation of this standard will have on the Company's consolidated financial statements.

In August 2018, the FASB issued ASU 2018-13, Fair Value Measurements (Topic 820): Disclosure Framework-Changes to the Disclosure Requirements for Fair Value Measurements ("ASU 2018-13"). The provisions of ASU 2018-13 modify the disclosures related to recurring and nonrecurring fair value measurements. Disclosures related to the transfer of assets between Level 1 and Level 2 hierarchies have been eliminated and various additional disclosures related to Level 3 fair value measurements have been added, modified or removed. The guidance is effective for annual periods and interim periods within those annual periods beginning after December 15, 2019, but entities are permitted to early adopt either the entire standard or only the provisions that eliminate or modify the requirements. This standard is effective for the Company for the year ending December 31, 2020. The Company is currently evaluating the impact that the implementation of this standard will have on the Company's consolidated financial statements.

In June 2018, the FASB issued ASU 2018-07, Compensation-Stock Compensation (Topic 718): Improvements to Nonemployee Share-Based Payment Accounting ("ASU 2018-07"). The provisions of ASU 2018-07 expand the scope of ASC 718 to include share-based payment transactions for acquiring goods and services from nonemployees. The guidance is effective for annual periods and interim periods within those annual periods beginning after December 15, 2018, with early adoption permitted no earlier than an entity's adoption date of ASC 606, and is effective for the Company for the year ending December 31, 2019. The Company is currently evaluating the impact that the implementation of this standard will have on the Company's consolidated financial statements.

In June 2016, the FASB issued ASU 2016-13, Financial Instruments-Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments ("ASU 2016-13"). The provisions of ASU 2016-13 modify the impairment model to utilize an expected loss methodology in place of the currently used incurred loss methodology, and requires a consideration of a broader range of reasonable and supportable information to inform credit loss estimates. The guidance is effective for annual periods and interim periods within those annual periods beginning after December 15, 2019, with early adoption permitted, and is effective for the Company for the year ending December 31, 2020. The Company is currently evaluating the impact that the implementation of this standard will have on the Company's

consolidated financial statements.

Reclassifications

Certain insignificant reclassifications have been made to the prior year consolidated financial statements to conform to the current year presentation.

Table of Contents

3. Mergers and Acquisitions

Asset Acquisition of Certain Harvest Entities

In September 2018, the Company, through its wholly owned subsidiary ActoBio, issued $30,000 of convertible promissory notes to Harvest, a related party, to acquire Harvest's ownership in CRS Bio, Inc. ("CRS Bio"); Genten Therapeutics, Inc. ("Genten Therapeutics"); and Relieve Genetics, Inc. ("Relieve Genetics") (collectively the "Harvest entities") (Note 17). The Company also received $15,500 cash in the transaction from the acquisition of the Harvest entities. Prior to the transaction, the Company held a noncontrolling interest in the Harvest entities, with a combined carrying value for all entities of $4,303, and accounted for its ownership using the equity method of accounting. Following the transaction, the Company owns 100% of the equity interests of the Harvest entities including the rights that had been previously licensed to the Harvest entities by the Company. The Harvest entities did not meet the definition of a business and accordingly, the transaction was accounted for as an asset acquisition.

By reacquiring the rights previously licensed to the Harvest entities, the Company is relieved from its obligations under the original ECCs and therefore wrote off deferred revenue of $10,078 as part of the transaction. The remaining value acquired of $8,721 was considered in-process research and development related to the reacquired rights under the ECCs and expensed immediately.

See Note 12 for additional discussion of the convertible promissory notes.

GenVec Acquisition

In June 2017, pursuant to an Agreement and Plan of Merger (the "GenVec Merger Agreement"), the Company acquired 100% of the outstanding shares of GenVec, Inc. ("GenVec"), a clinical-stage company and pioneer in the development of AdenoVerse gene delivery technology. Pursuant to the GenVec Merger Agreement, the former shareholders of GenVec received an aggregate of 684,240 shares of the Company's common stock and have the right to receive contingent consideration equal to 50% of any milestone or royalty payments received under one of GenVec's collaboration agreements, provided such payments are received within three years after the closing of the transaction. The Company also assumed warrants held by certain former shareholders of GenVec. The results of GenVec's operations subsequent to the acquisition date have been included in the consolidated financial statements. The fair value of the total consideration transferred was $17,582. The acquisition date fair value of each class of consideration transferred is presented below:

Common shares	$15,616
Warrants	1,381
Contingent consideration	585
	$17,582

Table of Contents

The fair value of the shares of the Company's common stock issued was based on the quoted closing price of the Company's common stock immediately prior to the closing of the acquisition. The fair value of the warrants assumed was estimated using the Black-Scholes option-pricing model. The fair value of the contingent consideration was determined using a probability weighted discounted cash flows model and is considered a freestanding financial instrument and recorded at fair value each reporting period. The estimated fair value of assets acquired and liabilities assumed at the acquisition date is shown below:

Cash and cash equivalents	$2,054
Short-term investments	542
Trade receivables	75
Other receivables	97
Prepaid expenses and other	227
Property and equipment	250
Intangible assets	14,000
Other noncurrent assets	58
Total assets acquired	17,303
Accounts payable	2,158
Accrued compensation and benefits	1,226
Other accrued expenses	856
Other long-term liabilities	92
Deferred tax liabilities	239
Total liabilities assumed	4,571
Net assets acquired	12,732
Goodwill	4,850
Total consideration	$17,582

The acquired intangible assets include developed technology, the fair value of which was determined using the multi-period excess earning method, which is a variation of the income approach that converts future cash flows to single discounted present value amounts. The intangible assets are being amortized over a useful life of eleven years. Goodwill, which is not deductible for tax purposes, represents the assembled workforce and the anticipated buyer-specific synergies arising from the combination of the Company's and GenVec's technology.

Acquisition-related costs totaling $507 and $12 are included in selling, general and administrative expenses in the accompanying consolidated statements of operations for the years ended December 31, 2017 and 2016, respectively.

Unaudited Condensed Pro Forma Financial Information

GenVec's results of operations subsequent to the acquisition are included in the consolidated statements of operations. The following unaudited condensed pro forma financial information for the years ended December 31, 2017 and 2016, is presented as if the acquisition had been consummated on January 1, 2016:

	Year Ended December 31,	
	2017	2016
	Pro Forma	
Revenues	$231,213	$191,437
Loss before income taxes	(136,966)	(201,210)
Net loss	(134,275)	(197,144)
Net loss attributable to the noncontrolling interests	9,802	3,662
Net loss attributable to Intrexon	(124,473)	(193,482)

Table of Contents

4. Investments in Joint Ventures

Intrexon Energy Partners

In March 2014, the Company and certain investors (the "IEP Investors"), including an affiliate of Third Security, LLC ("Third Security"), a related party, entered into a Limited Liability Company Agreement that governs the affairs and conduct of business of Intrexon Energy Partners, LLC ("Intrexon Energy Partners"), a joint venture formed to optimize and scale-up the Company's methane bioconversion platform ("MBP") technology for the production of certain fuels and lubricants. The Company also entered into an ECC with Intrexon Energy Partners providing exclusive rights to the Company's technology for the use in bioconversion, as a result of which the Company received a technology access fee of $25,000 while retaining a 50% membership interest in Intrexon Energy Partners. The IEP Investors made initial capital contributions, totaling $25,000 in the aggregate, in exchange for pro rata membership interests in Intrexon Energy Partners totaling 50%. In addition, Intrexon has committed to make capital contributions of up to $25,000, and the IEP Investors, as a group and pro rata in accordance with their respective membership interests in Intrexon Energy Partners, have committed to make additional capital contributions of up to $25,000, at the request of Intrexon Energy Partners' board of managers (the "Intrexon Energy Partners Board") and subject to certain limitations. As of December 31, 2018, the Company's remaining commitment was $4,938. Intrexon Energy Partners is governed by the Intrexon Energy Partners Board, which has five members. Two members of the Intrexon Energy Partners Board are designated by the Company and three members are designated by a majority of the IEP Investors. The Company and the IEP Investors have the right, but not the obligation, to make additional capital contributions above the initial limits when and if solicited by the Intrexon Energy Partners Board.

The Company's investment in Intrexon Energy Partners was $(656) and $(444) as of December 31, 2018 and 2017, respectively, and is included in other accrued liabilities in the accompanying consolidated balance sheets.

Intrexon Energy Partners II

In December 2015, the Company and certain investors (the "IEPII Investors"), including Harvest, entered into a Limited Liability Company Agreement that governs the affairs and conduct of business of Intrexon Energy Partners II, LLC ("Intrexon Energy Partners II"), a joint venture formed to utilize the Company's MBP technology for the production of 1,4-butanediol, an industrial chemical used to manufacture spandex, polyurethane, plastics, and polyester. The Company also entered into an ECC with Intrexon Energy Partners II that provides exclusive rights to the Company's technology for use in the field, as a result of which the Company received a technology access fee of $18,000 while retaining a 50% membership interest in Intrexon Energy Partners II. The IEPII Investors made initial capital contributions, totaling $18,000 in the aggregate, in exchange for pro rata membership interests in Intrexon Energy Partners II totaling 50%. In December 2015, the owners of Intrexon Energy Partners II made a capital contribution of $4,000, half of which was paid by the Company. Intrexon has committed to make additional capital contributions of up to $10,000, and the IEPII Investors, as a group and pro rata in accordance with their respective membership interests in Intrexon Energy Partners II, have committed to make additional capital contributions of up to $10,000, at the request of Intrexon Energy Partners II's board of managers (the "Intrexon Energy Partners II Board") and subject to certain limitations. Intrexon Energy Partners II is governed by the Intrexon Energy Partners II Board, which has five members. One member of the Intrexon Energy Partners II Board is designated by the Company and four members are designated by a majority of the IEPII Investors. The Company and the IEPII Investors have the right, but not the obligation, to make additional capital contributions above the initial limits when and if solicited by the Intrexon Energy Partners II Board.

The Company's investment in Intrexon Energy Partners II was $(50) and $572 as of December 31, 2018 and 2017, respectively, and is included in other accrued liabilities and investments in affiliates, respectively, in the accompanying consolidated balance sheets.

EnviroFlight

In February 2016, the Company entered into a series of transactions involving EnviroFlight, LLC ("Old EnviroFlight"), Darling Ingredients Inc. ("Darling") and a newly formed venture between the Company and Darling ("New EnviroFlight"). The Company determined that the series of integrated transactions to acquire substantially all of the assets of Old EnviroFlight for cash, common stock, and contingent consideration should be accounted for as a single transaction, which constituted a business, and considered New EnviroFlight to be the accounting acquirer.

Consideration paid to Old EnviroFlight was $4,244 in cash, 136,340 shares of the Company's common stock valued at $4,401 and contingent consideration estimated at $3,660. Contemporaneously, all the assets acquired from Old EnviroFlight, with the exception of certain developed technology, and $3,000 of cash were contributed to New EnviroFlight in exchange for a non-controlling, 50% membership interest in New EnviroFlight. The Company's contributions to New EnviroFlight included an exclusive license to the developed technology that was retained by the Company. Darling received the remaining 50% membership interest in New EnviroFlight as consideration for terminating rights previously held in the developed technology with Old EnviroFlight. New EnviroFlight was formed to

Table of Contents

generate high-nutrition, low environmental impact animal and fish feed, as well as fertilizer products, from black soldier fly larvae. Through December 31, 2018, both the Company and Darling have made subsequent capital contributions of $17,000. All of the employees of Old EnviroFlight became employees of New EnviroFlight.

The Company determined that its investment in New EnviroFlight should be accounted for using the equity method of accounting. The Company recorded an estimated fair value of $5,425 for its investment in New EnviroFlight and $9,880 for the retained developed technology intangible asset. The developed technology is being amortized over a period of twenty-one years. The contingent consideration liability payable to the members of Old EnviroFlight is considered a freestanding financial instrument and is recorded at fair value each reporting period. New EnviroFlight met a regulatory milestone, as defined in the asset purchase agreement, and the members of Old EnviroFlight received a portion of the contingent consideration consisting of 59,337 shares of the Company's common stock valued at $1,583 in October 2016. The members of Old EnviroFlight had a right to receive up to $4,000 of additional shares of the Company's common stock if certain commercial milestones were met prior to February 2019. No liability was recorded as of December 31, 2018 (Note 8), and these commercial milestones were not met prior to February 2019.

The Company's investment in New EnviroFlight was $16,720 and $7,092 as of December 31, 2018 and 2017, respectively, and is included in investments in affiliates in the accompanying consolidated balance sheets.

Intrexon T1D Partners

In March 2016, the Company and certain investors (the "T1D Investors"), including affiliates of Third Security, entered into a Limited Liability Company Agreement that governs the affairs and conduct of business of Intrexon T1D Partners, LLC ("Intrexon T1D Partners"), a joint venture formed to utilize the Company's proprietary ActoBiotics platform to develop and commercialize products to treat type 1 diabetes. The Company also entered into an ECC with Intrexon T1D Partners that provides the exclusive rights to the Company's technology for use in the field, as a result of which the Company received a technology access fee of $10,000 while retaining a 50% membership interest in Intrexon T1D Partners. The T1D Investors made initial capital contributions, totaling $10,000 in the aggregate, in exchange for pro rata membership interests in Intrexon T1D Partners totaling 50%. Intrexon committed to make capital contributions of up to $5,000, and the T1D Investors, as a group and pro rata in accordance with their respective membership interests in Intrexon T1D Partners, committed to make additional capital contributions of up to $5,000, at the request of Intrexon T1D Partners' board of managers, which consisted of two members appointed by the Company and three members appointed by a majority of the T1D Investors. The Company satisfied its commitment in 2018.

In November 2018, the Company, together with its wholly owned subsidiary ActoBio, issued 1,933,737 shares of Intrexon common stock valued at $18,970 to the T1D Investors to acquire their ownership interest in Intrexon T1D Partners. Following the transaction, the Company owns 100% of the membership interests in Intrexon T1D Partners, including the rights that had been previously licensed to Intrexon T1D Partners by the Company in the ECC. Intrexon T1D Partners did not meet the definition of a business, and accordingly, the transaction was accounted for as an asset acquisition. By reacquiring the rights previously licensed to Intrexon T1D Partners, the Company was relieved from its obligations under the original ECC and therefore wrote off $8,517 of deferred revenue as part of the transaction. The remaining value of $10,453 was considered in-process research and development related to the reacquired rights under the ECC and expensed immediately.

Other Joint Ventures

In December 2013, the Company and OvaScience, Inc. ("OvaScience") formed a joint venture, OvaXon, LLC ("OvaXon"). Additionally, the Company entered into separate ECC agreements with OvaXon and OvaScience. In March 2018, the Company and OvaScience agreed to terminate the ECC agreement with OvaScience. The Company and Millendo Therapeutics, Inc., a company that subsequently acquired OvaScience, are in discussions regarding the future of the OvaXon joint venture and the related ECC agreement.

In September 2013, the Company and Sun Pharmaceutical Industries, Inc. ("Sun Pharmaceutical Industries") formed a joint venture, S & I Ophthalmic, LLC ("S & I Ophthalmic"), which entered into an ECC agreement with the Company. In December 2017, both the Company and Sun Pharmaceutical Industries agreed to dissolve S & I Ophthalmic and terminate the related ECC agreement. In January 2018, the Company received $2,598 upon the dissolution of S & I Ophthalmic, which represented the Company's portion of S & I Ophthalmic's remaining cash after

all liabilities were settled.

Table of Contents

5. Collaboration and Licensing Revenue

The Company's collaborations and licensing agreements provide for multiple promises to be satisfied by the Company and typically include a license to the Company's technology platforms, participation in collaboration committees, and performance of certain research and development services. Based on the nature of the promises in the Company's collaboration and licensing agreements, the Company typically combines most of its promises into a single performance obligation because the promises are highly interrelated and not individually distinct. At contract inception, the transaction price is typically the upfront payment received and is allocated to the single performance obligation. The Company has determined the transaction price should be recognized as revenue based on its measure of progress under the agreement primarily based on inputs necessary to fulfill the performance obligation.

See Note 2 for additional discussion of the Company's revenue recognition policy related to collaboration and licensing payments.

The Company determines whether collaborations and licensing agreements are individually significant for disclosure based on a number of factors, including total revenue recorded by the Company pursuant to collaboration and licensing agreements, collaborators or licensees with either majority-owned subsidiaries or equity method investments, or other qualitative factors. Collaboration and licensing revenues generated from consolidated subsidiaries are eliminated in consolidation. Amounts for periods subsequent to January 1, 2018 reflect revenue recognition under ASC 606.

The following tables summarize the amounts recorded as revenue in the consolidated statements of operations for each significant counterparty to a collaboration or licensing agreement for the years ended December 31, 2018, 2017 and 2016.

	Year Ended December 31,		
	2018	2017	2016
ZIOPHARM Oncology, Inc.	$16,298	$69,812	$33,836
Ares Trading S.A.	11,175	10,738	10,192
Oragenics, Inc.	1,353	2,020	2,752
Intrexon T1D Partners, LLC	2,502	5,968	1,908
Intrexon Energy Partners, LLC	6,929	10,665	17,552
Intrexon Energy Partners II, LLC	2,998	3,672	3,169
Genopaver, LLC	3,710	6,690	6,117
Fibrocell Science, Inc.	1,394	7,344	5,942
Persea Bio, LLC	955	946	1,278
OvaXon, LLC	—	1,966	2,934
S & I Ophthalmic, LLC	—	755	6,141
Harvest start-up entities (1)	14,447	15,232	4,974
Other	15,108	9,771	13,076
Total	$76,869	$145,579	$109,871

(1) For the years ended December 31, 2018, 2017, and 2016, revenue recognized from collaborations with Harvest start-up entities include Genten Therapeutics, Inc.; CRS Bio, Inc.; Exotech Bio, Inc.; AD Skincare, Inc.; and Thrive Agrobiotics, Inc. For the years ended December 31, 2017 and 2016, revenue recognized from collaborations with Harvest start-up entities also include Relieve Genetics, Inc.

The following is a summary of the terms of the Company's significant collaborations and licensing agreements.

ZIOPHARM Collaborations

In January 2011, the Company entered into an ECC with ZIOPHARM Oncology, Inc. ("ZIOPHARM"), a related party at the time. Pursuant to the ECC, ZIOPHARM received a license to the Company's technology platform within the field of oncology as defined more specifically in the agreement. Upon execution of the ECC, the Company received 3,636,926 shares of ZIOPHARM's common stock valued at $17,457 as upfront consideration. In addition to the promises discussed above, the Company transferred two clinical product candidates to ZIOPHARM for which $1,115 of the upfront consideration was allocated and recognized as collaboration revenue in 2011. The remaining $16,342 of upfront consideration was allocated to a

Table of Contents

single performance obligation as discussed above. The Company was entitled to additional shares of common stock at the date of the dosing of the first patient in a Phase II clinical trial of a product candidate created, produced or developed by ZIOPHARM using the Company's technology ("ZIOPHARM Milestone"). In October 2012, the ZIOPHARM Milestone was achieved and the Company received 3,636,926 shares of ZIOPHARM's common stock valued at $18,330 as milestone consideration. Upon adoption of ASC 606, the Company recorded a cumulative catch-up adjustment of $873 related to milestone consideration. The Company allocated the ZIOPHARM Milestone to the two performance obligations and recognized those in a manner similar to the discussion above. The Company received reimbursement payments for research and development services provided and manufacturing services for Company materials provided to ZIOPHARM during the ECC. In March 2015, in conjunction with the worldwide License and Collaboration Agreement ("Merck Agreement") with Ares Trading S.A. ("Ares Trading"), a wholly owned subsidiary of Merck KGaA, and ZIOPHARM discussed below, the Company and ZIOPHARM amended their existing ECC. The amendment modified the scope of the ECC in connection with the Merck Agreement and provided that the Company would pay to ZIOPHARM 50% of all payments received for upfront fees, milestones and royalties under the Merck Agreement. See discussion of the Merck Agreement below.

In September 2015, the Company entered into its second ECC with ZIOPHARM ("ZIOPHARM ECC 2"). Pursuant to the ECC, ZIOPHARM received a license to the Company's technology platform to develop and commercialize novel biotherapeutics for the treatment of patients with graft-versus-host disease, or GvHD. Upon execution of ZIOPHARM ECC 2, the Company received a technology access fee of $10,000. The Company received reimbursement payments for research and development services provided pursuant to the agreement during the ECC and manufacturing services for Company materials provided to ZIOPHARM during the ECC. In December 2017, the Company and ZIOPHARM mutually agreed to terminate ZIOPHARM ECC2 and accordingly, the Company recognized the remaining balance of the deferred revenue associated with ZIOPHARM ECC2 totaling $28,943.

In June 2016, the Company amended each of its two existing collaboration agreements with ZIOPHARM and as a result the rate of the royalty that the Company is entitled to receive on certain products commercialized pursuant to the agreements was reduced from 50% to 20%. As consideration for execution of the amendments, ZIOPHARM issued the Company 100,000 shares of ZIOPHARM's Series 1 Preferred Stock valued at $120,000. The Company allocated the consideration received to each ECC based on the cumulative value of upfront and milestone payments previously received pursuant to that ECC. Upon adoption of ASC 606, the Company recognized a cumulative catch-up adjustment of $32,422 as a result of the contract modification requiring a cumulative catch-up under ASC 606 versus prospective recognition under previous revenue recognition accounting standards. See Note 7 for additional discussion of the terms of the preferred stock and the accounting treatment.

In October 2018, the Company, through its wholly owned subsidiary Precigen, entered into a license agreement (the "ZIOPHARM License Agreement") with ZIOPHARM, which terminated and replaced the terms of the original ZIOPHARM ECC, including the amendments thereto. Pursuant to the terms of the ZIOPHARM License Agreement, the Company granted ZIOPHARM an exclusive, worldwide, royalty-bearing, sub-licensable license to research, develop and commercialize (i) products utilizing the Company's RheoSwitch gene switch ("RTS") to express IL-12 (the "IL-12 Products") for the treatment of cancer, (ii) chimeric antigen receptor ("CAR") products directed to (a) CD19 for the treatment of cancer (the "CD19 Products"), and (b) a second target, subject to the rights of the Company to pursue such target under the Merck Agreement, and (iii) T-cell receptor ("TCR") products (the "TCR Products") designed for neoantigens for the treatment of cancer or the treatment and prevention of human papilloma virus ("HPV") to the extent that the primary reason for such treatment or prevention is to prevent cancer, which is referred to as the HPV Field. The Company has also granted ZIOPHARM an exclusive, worldwide, royalty-bearing, sub-licensable license for certain patents relating to the Company's Sleeping Beauty technology to research, develop and commercialize TCR Products for both neoantigens and shared antigens for the treatment of cancer and in the HPV Field. ZIOPHARM will be solely responsible for all aspects of the research, development and commercialization of the exclusively licensed products for the treatment of cancer. ZIOPHARM is required to use commercially reasonable efforts to develop and commercialize IL-12 Products and CD19 Products, and after a two-year period, the TCR Products. The Company also granted ZIOPHARM an exclusive, worldwide, royalty-bearing, sub-licensable license to research, develop and commercialize products utilizing an additional construct that expresses RTS IL-12 (the "Gorilla

IL-12 Products") for the treatment of cancer and in the HPV Field. ZIOPHARM is responsible for all development costs associated with each of the licensed products, other than Gorilla IL-12 Products. ZIOPHARM and the Company will share the development costs and operating profits for Gorilla IL-12 Products, with ZIOPHARM responsible for 80% of the development costs and receiving 80% of the operating profits, as defined in the ZIOPHARM License Agreement, and the Company responsible for the remaining 20% of the development costs and receiving 20% of the operating profits, except that ZIOPHARM will bear all development costs and the Company will share equally in operating profits for Gorilla IL-12 Products in the HPV Field (the "Gorilla Program").

Table of Contents

In consideration of the licenses and other rights granted by the Company, ZIOPHARM will pay the Company an annual license fee of $100 and agreed to reimburse the Company $1,000, payable in four quarterly installments, with respect to historical Gorilla IL-12 Products (the "historical Gorilla reimbursements"). ZIOPHARM will make milestone payments, payable upon the initiation of later stage clinical trials and upon the approval of exclusively licensed products in various jurisdictions, totaling up to an additional $52,500 for each of four exclusively licensed products, up to an aggregate of $210,000. In addition, ZIOPHARM will pay the Company tiered royalties ranging from low-single digits to high-single digits on the net sales derived from the sales of any approved IL-12 Products and CAR products. ZIOPHARM will also pay the Company royalties ranging from low-single digits to mid-single digits on the net sales derived from the sales of any approved TCR Products, up to maximum royalty amount of $100,000 in the aggregate. ZIOPHARM will also pay the Company 20% of any sublicensing income received by ZIOPHARM relating to the licensed products.

The Company reacquired rights to research, develop and commercialize CAR products for all other targets. In addition, the Company may research, develop and commercialize products for the treatment of cancer, outside of the products exclusively licensed to ZIOPHARM. The Company will pay ZIOPHARM royalties ranging from low-single digits to mid-single digits on the net sales derived from the sale of the Company's CAR products, up to $50,000. The Company will also be entitled to receive from ZIOPHARM reimbursement of costs incurred to transition the necessary knowledge and materials for ZIOPHARM programs for a period of up to one year from the effective date (the "Transition Services").

As between the parties, the Company agreed to perform all of the obligations of ZIOPHARM under the Merck Agreement, other than an obligation of exclusivity thereunder and ZIOPHARM will remain responsible for all payments owed under the Merck Agreement with respect to CD19 and the other target under the Merck Agreement as a result of ZIOPHARM's, its affiliates' or its sublicensees' exploitation of CAR products. Further, the Company is entitled to receive all rights and financial considerations with respect to all other CAR products, subject to the CAR royalties due to ZIOPHARM for such products. The ZIOPHARM License Agreement will terminate on a product-by-product and/or country-by-country basis upon the expiration of the later to occur of (i) the expiration of the last to expire patent claim for a licensed product, or (ii) 12 years after the first commercial sale of a licensed product in such country. In addition, ZIOPHARM may terminate the ZIOPHARM License Agreement on a country-by-country or program-by-program basis following written notice to the Company, and either party may terminate the ZIOPHARM License Agreement following notice of a material breach.

Pursuant to the ZIOPHARM License Agreement, the 2016 Securities Issuance Agreement between the Company and ZIOPHARM was terminated as of the effective date of the ZIOPHARM License Agreement, all of the benefits, rights, obligations and liabilities thereunder immediately ceased and terminated and the Company returned to ZIOPHARM all of the preferred stock owned by the Company as of the Effective Date, which was valued at $158,376. See Note 7 for additional discussion of the preferred stock.

Prior to the execution of the ZIOPHARM License Agreement, the Company had $51,084 of deferred revenue remaining from the original ECC, which was related to the Company's obligations to perform under that agreement. Replacement of the original ECC with the ZIOPHARM License Agreement is a contract modification under ASC 606 that represents the termination of the original agreement and the creation of a new agreement as the remaining rights, obligations, and services to be exchanged, which are limited to the Transition Services, are distinct from those under the ECC. Therefore, the Company reviewed the various forms of consideration in the ZIOPHARM License Agreement to determine the transaction price. As the Company's obligations under the ZIOPHARM License Agreement are only related to the Transition Services and no other obligations under the ECC remain, a portion of the previously deferred revenue from the ECC should be relieved, which the Company determined to be $49,329, and the remaining $1,755 was included in the transaction price. The initial annual license payment of $100 was also included in the transaction price. The remaining annual license payments and potential milestone payments were constrained at the modification date and will only be recognized when the payments become probable of being received. Royalty payments from sales of ZIOPHARM products developed pursuant to the ZIOPHARM License Agreement will be recognized when the sales occur. The Company will recognize payments from Transition Services as those services are performed and will recognize the transaction price of $1,855 as it performs the Transition Services required under

the ZIOPHARM License Agreement.

The Company also reviewed the consideration paid and potential consideration to be paid to ZIOPHARM as part of the ZIOPHARM License Agreement, which includes the $158,376 of ZIOPHARM preferred stock returned by the Company and potential royalty payments to ZIOPHARM from sales of the Company's CAR products. The Company determined the exchange of its investment in ZIOPHARM preferred stock for certain CAR rights previously licensed under the ECC (i.e., in-process research and development) and the relief of performance obligations to ZIOPHARM under the ECC constituted an exchange for distinct goods and services. Therefore, the Company wrote off the $49,329 of relieved deferred revenue and recorded an expense of $109,047 for the reacquired in-process research and development. Potential royalty payments to ZIOPHARM will be expensed as incurred as they relate to distinct goods or services.

Table of Contents

The Company determined that the Gorilla Program represents a separate collaboration agreement under the scope of ASC 808, Collaborative Arrangements, ("ASC 808") and will not be included in the accounting for the ZIOPHARM License Agreement under ASC 606. The Company recognized $500 of the historical Gorilla reimbursements on the contract modification date and will recognize the remaining amounts when receipt is probable. The development costs and operating profits from the Gorilla Program will be recognized in accordance with ASC 808.

Merck Licensing Agreement

In March 2015, the Company signed the Merck Agreement with Ares Trading and ZIOPHARM through which the parties established a collaboration for the research and development and commercialization of certain products for the prophylactic, therapeutic, palliative or diagnostic use for cancer in humans. Pursuant to the Merck Agreement, the Company received a technology access fee of $115,000 as upfront consideration, of which $57,500 was paid to ZIOPHARM in accordance with the terms of the agreement. Upon the selection of the first two targets by Ares Trading, the Company received $10,000 in equal quarterly installments over two years.

In December 2018, the Company entered into a Securities Purchase, Assignment and Assumption Agreement (the "Merck Purchase Agreement") with Ares Trading pursuant to which the Company reacquired Ares Trading's development and commercialization rights under the Merck Agreement. As consideration for the reacquisition of the Merck Agreement, the Company issued Ares Trading 20,640,119 shares of Intrexon common stock valued at $140,353 and agreed to pay Ares Trading a royalty of 10% of the net sales derived from two CAR products specified in the Merck Purchase Agreement. By reacquiring the rights previously licensed to Ares Trading, the Company is relieved of its obligations under the Merck Agreement and therefore wrote off deferred revenue of $31,826. The remaining value acquired of $108,527 was considered in-process research and development related to the reacquired rights under the Merck Agreement and expensed immediately. The potential future royalty payments to Ares Trading do not represent consideration paid to a customer and will be recorded when the payments are probable. See Note 12 for additional discussion of this transaction.

Oragenics Collaborations

In June 2012, the Company entered into an ECC with Oragenics, a publicly traded company focused on becoming the world leader in novel antibiotics against infectious diseases and a related party. Pursuant to the ECC, at the transaction effective date, Oragenics received a license to the Company's technology platform within the field of lantibiotics for the treatment of infectious diseases in humans and companion animals as defined more specifically in the agreement. Upon execution of the ECC, the Company received a technology access fee of 439,243 shares of Oragenics' common stock valued at $6,588 as upfront consideration. In November 2017, the Company amended the ECC agreement with Oragenics, and as a result, the Company is entitled to up to $35,000 of potential one-time payments for certain regulatory milestones. The Company receives reimbursement payments for research and development services provided pursuant to the agreement during the ECC and manufacturing services for Company materials provided to Oragenics during the ECC. Oragenics will pay the Company 25% of the quarterly profits derived from the sale of products developed from the ECC, as defined in the agreement.

Oragenics is responsible for funding the further development of lantibiotics toward the goal of commercialization, conducting preclinical and clinical development of product candidates, as well as for other aspects of commercialization or manufacturing of the product candidates. The term of the ECC commenced in June 2012 and continues until terminated pursuant to the ECC agreement. The ECC may be terminated by either party in the event of certain material breaches defined in the agreement and may be terminated voluntarily by Oragenics upon 90 days written notice to the Company.

In June 2015, the Company entered into a separate ECC with Oragenics ("Oragenics ECC 2"). Pursuant to Oragenics ECC 2, at the transaction effective date, Oragenics received a license to the Company's technology platform within the field of biotherapeutics for use in certain treatments of oral mucositis and other diseases and conditions of the oral cavity, throat, and esophagus. Upon execution of Oragenics ECC 2, the Company received a technology access fee of a $5,000 convertible promissory note maturing on or before December 31, 2015 as upfront consideration. Prior to the maturity date, Oragenics had the right to convert the promissory note into shares of Oragenics' common stock, subject to its shareholders' approval. In December 2015, Oragenics converted the promissory note into 338,100 shares of Oragenics' common stock. Following an amendment in November 2017, the Company is entitled to up to $37,500 of

potential one-time payments for development and commercial milestones under Oragenics ECC 2. The Company receives reimbursement payments for research and development services provided pursuant to the agreement during Oragenics ECC 2 and manufacturing services for Company materials provided to Oragenics during Oragenics ECC 2. Oragenics will pay the Company royalties as a percentage in the low-teens of net sales derived from the sale of products developed from Oragenics ECC 2, as defined in the agreement.

Table of Contents

Oragenics is responsible for funding the further development of Oragenics ECC 2 products towards the goal of commercialization, conducting preclinical and clinical development of product candidates, as well as for other aspects of commercialization or manufacturing of the product candidates. The term of the ECC commenced in June 2015 and may be terminated by either party in the event of certain material breaches defined in the agreement and may be terminated voluntarily by Oragenics upon 90 days written notice to the Company.

Intrexon T1D Partners Collaboration

In March 2016, the Company entered into an ECC with Intrexon T1D Partners, a joint venture between the Company and certain investors and a related party. Pursuant to the ECC, Intrexon T1D Partners received an exclusive license to the Company's technology platform to develop and commercialize products to treat type 1 diabetes. Upon execution of the ECC, the Company received a technology access fee of $10,000. The Company received reimbursement of research and development services provided pursuant to the ECC agreement. In November 2018, the Company completed an asset acquisition with the T1D Investors, resulting in the Company owning 100% of the membership interest of Intrexon T1D Partners including all rights under the ECC (Note 4).

Genten Therapeutics Collaboration

In September 2016, the Company entered into an ECC with Genten Therapeutics, an affiliate of Harvest and a related party. Genten Therapeutics was formed for the purpose of entering into the ECC and developing and commercializing products using the Company's technology for expression of gluten peptides, alone or in combination with immunomodulatory cytokines, to reestablish immune tolerance for patients with celiac disease. Upon execution of the ECC, the Company received a technology access fee in the form of a $1,500 cash payment and equity in Genten Therapeutics valued at $3,000 as upfront consideration. The Company received reimbursement payments for research and development services provided pursuant to the ECC. In September 2018, the Company completed an asset acquisition with Harvest, resulting in the Company owning 100% of the equity interests of Genten Therapeutics including all rights under the ECC (Note 3).

CRS Bio Collaboration

In September 2016, the Company entered into an ECC with CRS Bio, an affiliate of Harvest and a related party. CRS Bio was formed for the purpose of entering into the ECC and developing and commercializing products through targeted delivery of antibodies for treatment of chronic rhinosinusitis with and without nasal polyps, by utilizing the Company's technology to block inflammatory mediators in the nasal passage, leading to improved breathing and, importantly, patients' quality of life. Upon execution of the ECC, the Company received a technology access fee in the form of equity in CRS Bio valued at $2,100. The Company received reimbursement payments for research and development services provided pursuant to the ECC. In September 2018, the Company completed an asset acquisition with Harvest, resulting in the Company owning 100% of the equity interests of CRS Bio including all rights under the ECC (Note 3).

Relieve Genetics Collaboration

In March 2016, the Company entered into an ECC with Relieve Genetics, an affiliate of Harvest and a related party. Relieve Genetics was formed for the purpose of entering into the ECC and developing and commercializing products using a viral vector expressing interleukin-10 for the treatment of chronic neuropathic pain resultant from cancer in humans. Upon execution of the ECC, the Company received a technology access fee in the form of equity in Relieve Genetics valued at $4,333 as upfront consideration. The Company received reimbursement payments for research and development services provided pursuant to the ECC. In September 2018, the Company completed an asset acquisition with Harvest, resulting in the Company owning 100% of the equity interests of Relieve Genetics including all rights under the ECC (Note 3).

Intrexon Energy Partners Collaboration

In March 2014, the Company entered into an ECC with Intrexon Energy Partners, a joint venture between the Company and certain investors and a related party. The ECC grants Intrexon Energy Partners an exclusive license to the Company's technology platform to optimize and scale-up the Company's methane bioconversion platform for the production of certain fuels and lubricants. Upon execution of the ECC, the Company received a technology access fee of $25,000 as upfront consideration. The Company receives reimbursement payments for research and development services as provided for in the ECC agreement. The term of the ECC commenced in March 2014 and continues until

March 2034 unless terminated prior to that date by either party in the event of certain material breaches defined in the agreement and may be terminated voluntarily by Intrexon Energy Partners upon 90 days written notice to the Company.

Table of Contents

Intrexon Energy Partners II Collaboration

In December 2015, the Company entered into an ECC with Intrexon Energy Partners II, a joint venture between the Company and certain investors and a related party. Pursuant to the ECC, Intrexon Energy Partners II received an exclusive license to the Company's technology platform to optimize and scale-up the Company's methane bioconversion platform for the production of 1,4-butanediol (BDO), a key chemical intermediate that is used to manufacture spandex, polyurethane, plastics, and polyester. Upon execution of the ECC, the Company received a technology access fee of $18,000 and is entitled to reimbursement of research and development services as provided for in the ECC agreement. The term of the ECC commenced in December 2015 and continues until December 2035; termination prior to that date may be initiated (i) by either party in the event of certain material breaches defined in the agreement or (ii) may be terminated voluntarily by Intrexon Energy Partners II upon 90 days written notice to the Company.

Exotech Bio Collaboration

In March 2016, the Company entered into an ECC with Exotech Bio, Inc. ("Exotech Bio"), an affiliate of Harvest and a related party. Exotech Bio was formed for the purpose of entering into the ECC and developing and commercializing products using exosomes carrying a RNA payload designed to kill, suppress, or render immune-visible a cancer cell. Upon execution of the ECC, the Company received a technology access fee in the form of equity in Exotech Bio valued at $5,000 as upfront consideration. In June 2018, the Company and Exotech Bio amended the ECC, which resulted in the expansion of the defined field of use and the Company's ownership in Exotech Bio increasing to 49%. The amendment also eliminated potential future milestone payments and royalties for which the Company was previously entitled. The Company receives reimbursement payments for research and development services provided pursuant to the ECC. The ECC may be terminated by either party in the event of certain material breaches defined in the agreement and may be terminated voluntarily by Exotech Bio upon 90 days written notice to the Company.

AD Skincare Collaboration

In June 2016, the Company entered into an ECC with AD Skincare, Inc. ("AD Skincare"), an affiliate of Harvest and a related party. AD Skincare was formed for the purpose of entering into the ECC and developing an advanced topical delivery system to improve the efficacy of biologically active ingredients aimed at improving signs of aging human skin. Upon execution of the ECC, the Company received a technology access fee in the form of equity in AD Skincare valued at $4,333 as upfront consideration. The Company is also entitled to up to $2,000 of potential payments for substantive and non-substantive development milestones for each product developed under the ECC, as well as up to $17,000 in one-time commercial milestones. The Company receives reimbursement payments for research and development services provided pursuant to the ECC. AD Skincare will pay the Company royalties as a percentage in the low double-digits on the quarterly net sales of products developed under the ECC, as defined in the agreement. AD Skincare is responsible for the development and commercialization of the product candidates. The term of the ECC commenced in June 2016 and continues until terminated pursuant to the ECC agreement. The ECC may be terminated by either party in the event of certain material breaches defined in the agreement and may be terminated voluntarily by AD Skincare upon 90 days written notice to the Company.

Genopaver Collaboration

In March 2013, the Company entered into an ECC with Genopaver, LLC ("Genopaver"), an affiliate of Third Security and a related party. Genopaver was formed for the purpose of entering into the ECC and developing and commercializing products in the field of the fermentative production of alkaloids through genetically modified cell-lines and substrate feeds for use as active pharmaceutical ingredients or as commercially sold intermediates in the manufacture of active pharmaceutical ingredients. Upon execution of the ECC, the Company received a technology access fee of $3,000 as upfront consideration. The Company receives reimbursement payments for research and development services provided pursuant to the agreement during the ECC. Genopaver will pay the Company royalties as a percentage in the lower-double digits on the quarterly gross profits of product sales from products developed under the ECC, as defined in the agreement. Genopaver is responsible for the development and commercialization of the product candidates. The term of the ECC commenced in March 2013 and continues until terminated pursuant to the ECC agreement. The ECC may be terminated by either party in the event of certain material breaches defined in

the agreement and may be terminated voluntarily by Genopaver upon 90 days written notice to the Company.

Fibrocell Science Collaborations

In October 2012, the Company entered into an ECC ("Fibrocell ECC 1") with Fibrocell Science, Inc. ("Fibrocell"), a publicly traded cell and gene therapy company focused on diseases affecting the skin and connective tissue and a related party. Pursuant to Fibrocell ECC 1, at the transaction effective date, Fibrocell received a license to the Company's technology platform to

Table of Contents

develop and commercialize genetically modified and non-genetically modified autologous fibroblasts and autologous dermal cells in the United States of America. Upon execution of Fibrocell ECC 1, the Company received a technology access fee of 87,835 shares of Fibrocell's common stock valued at $7,576 as upfront consideration. The Company receives reimbursement payments for research and development services provided pursuant to the agreement during Fibrocell ECC 1 and manufacturing services for Company materials provided to Fibrocell during Fibrocell ECC 1. On a quarterly basis, Fibrocell will pay the Company royalties of 7% of net sales up to $25,000 and 14% of net sales above $25,000 on each product developed from Fibrocell ECC 1, as defined in the agreement. If Fibrocell uses the Company's technology platform to improve the production of a current or new Fibrocell product not developed from Fibrocell ECC 1, Fibrocell will pay the Company quarterly royalties equal to 33% of the cost of goods sold savings generated by the improvement, as defined in the agreement.

Fibrocell is responsible for conducting preclinical and clinical development of product candidates associated with Fibrocell ECC 1, as well as for other aspects of commercialization and manufacturing of the product candidates. The term of the ECC commenced in October 2012 and continues until terminated pursuant to the ECC agreement. The ECC may be terminated by either party in the event of certain material breaches defined in the agreement and may be terminated voluntarily by Fibrocell upon 90 days written notice to the Company.

In June 2013, the Company and Fibrocell entered into an amendment to the Fibrocell ECC 1. The amendment expanded the field of use defined in the ECC agreement. Under the terms of the amendment to the Fibrocell ECC 1, the Company received 82,919 shares of Fibrocell's common stock valued at $7,612 as a supplemental technology access fee.

In December 2015, the Company entered into a second ECC with Fibrocell ("Fibrocell ECC 2"). Pursuant to the ECC, at the transaction effective date, Fibrocell received a license to the Company's technology platform to develop and commercialize genetically-modified fibroblasts to treat chronic inflammatory and degenerative diseases of the joint, including arthritis and related conditions. Upon execution of the ECC, the Company received a technology access fee of $10,000. The Company is also entitled to (i) up to $30,000 of potential one-time payments for certain development and regulatory milestones for the first product developed under Fibrocell ECC 2, (ii) up to $30,000 of potential payments for certain regulatory milestones for each additional product developed under Fibrocell ECC 2, and (iii) up to $22,500 of potential payments for certain sales milestones for each product developed under Fibrocell ECC 2. The Company receives reimbursement payments for research and development services provided pursuant to the agreement during the ECC and manufacturing services for Company materials provided to Fibrocell during the ECC. Fibrocell will pay the Company royalties as a percentage in the low double-digits of net sales derived from the sale of products developed from Fibrocell ECC 2, as defined in the agreement.

Fibrocell is responsible for conducting preclinical and clinical development of product candidates associated with Fibrocell ECC 2, as well as for other aspects of commercialization and manufacturing of the product candidates. The term of the ECC commenced in December 2015 and continues until terminated pursuant to the ECC agreement. The ECC may be terminated by either party in the event of certain material breaches defined in the agreement and may be terminated voluntarily by Fibrocell upon 90 days written notice to the Company.

All Fibrocell share data noted above reflect a 1-for-5 reverse stock split of Fibrocell's common stock effective May 25, 2018.

Thrive Agrobiotics Collaboration

In September 2015, the Company entered into an ECC with Thrive Agrobiotics, Inc. ("Thrive Agrobiotics"), an affiliate of Harvest and a related party. Thrive Agrobiotics was formed for the purpose of entering into the ECC and developing and commercializing products to improve the overall growth and feed efficiency in piglets. Upon execution of the ECC, the Company received a technology access fee in the form of equity in Thrive Agrobiotics valued at $1,667 as upfront consideration. The Company is also entitled to up to $5,500 of potential payments for development and commercial milestones for each product developed under the ECC. The Company receives reimbursement payments for research and development services provided pursuant to the agreement during the ECC. Thrive Agrobiotics will pay the Company royalties as a percentage in the lower-double digits on the quarterly gross profits of product sales from products developed under the ECC, as defined in the agreement. Thrive Agrobiotics is responsible for the development and commercialization of the product candidates. The term of the ECC commenced

in September 2015 and continues until terminated pursuant to the ECC agreement. The ECC may be terminated by either party in the event of certain material breaches defined in the agreement and may be terminated voluntarily by Thrive Agrobiotics upon 90 days written notice to the Company.

Persea Bio Collaboration

In December 2014, the Company entered into an ECC with Persea Bio, LLC ("Persea Bio"), an affiliate of Third Security and a related party. Persea Bio was formed for the purpose of entering into the ECC and developing and commercializing a food

Table of Contents

program, as defined in the agreement. Upon effectiveness of the ECC, the Company received a technology access fee of $5,000 as upfront consideration. The Company receives reimbursement payments for research and development services provided pursuant to the agreement during the ECC. Persea Bio will pay the Company royalties as a percentage in the lower-double digits on the quarterly gross profits of product sales from products derived from the ECC, as defined in the agreement. Persea Bio is responsible for the development and commercialization of the product candidates. The term of the ECC commenced in December 2014 and continues until terminated by either party in the event of certain material breaches defined in the agreement and may be terminated voluntarily by Persea Bio upon 90 days written notice to the Company.

AquaBounty Collaboration

In February 2013, the Company entered into an ECC with AquaBounty, a majority-owned consolidated subsidiary. The Company receives reimbursement payments for research and development services as provided for in the ECC agreement. In the event of product sales from a product developed from the ECC, the Company will receive 16.66% of quarterly gross profits for each product, as defined in the agreement. All revenues and expenses related to this ECC are eliminated in consolidation.

Deferred Revenue

Deferred revenue primarily consists of consideration received for the Company's collaborations and licensing agreements and prepayments for product and service revenues. Deferred revenue consists of the following:

	December 31,	
	2018	2017
Collaboration and licensing agreements	$63,284	$231,583
Prepaid product and service revenues	2,933	4,681
Other	3,547	133
Total	$69,764	$236,397
Current portion of deferred revenue	$15,554	$42,870
Long-term portion of deferred revenue	54,210	193,527
Total	$69,764	$236,397

Table of Contents

The following table summarizes the remaining balance of deferred revenue associated with upfront and milestone payments for each significant counterparty to a collaboration or licensing agreement as of December 31, 2018 and 2017, including the estimated remaining performance period as of December 31, 2018. See discussion above for significant changes to our ECCs in 2018, including ZIOPHARM and Ares Trading.

	Average Remaining Performance Period (Years)	December 31,	
		2018	2017
ZIOPHARM Oncology, Inc.	0.8	$1,214	$90,496
Ares Trading S.A.	0.0	—	40,789
Oragenics, Inc.	5.4	5,810	6,719
Intrexon T1D Partners, LLC	0.0	—	8,435
Intrexon Energy Partners, LLC	5.3	10,267	15,625
Intrexon Energy Partners II, LLC	5.9	14,060	13,833
Genopaver, LLC	5.3	1,175	1,704
Fibrocell Science, Inc.	5.9	17,519	16,607
Persea Bio, LLC	6.0	2,697	3,500
Harvest start-up entities (1)	6.2	7,644	18,400
Other	2.3	2,898	14,423
Total		$63,284	$230,531

(1) As of December 31, 2018 and December 31, 2017, the balance of deferred revenue for collaborations with Harvest start-up entities includes Exotech Bio, Inc.; AD Skincare, Inc.; and Thrive Agrobiotics, Inc. As of December 31, 2017, the balance of deferred revenue for collaborations with Harvest start-up entities also includes: Genten Therapeutics, Inc.; CRS Bio, Inc.; and Relieve Genetics, Inc. See Note 3 for further discussion of the asset acquisition of certain Harvest entities.

6. Short-term Investments

The Company's investments are classified as available-for-sale. The following table summarizes the amortized cost, gross unrealized gains and losses, and fair value of available-for-sale investments as of December 31, 2018:

	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Aggregate Fair Value
United States government debt securities	$119,401	$—	$(61)	$119,340
Certificates of deposit	348	—	—	348
Total	$119,749	$—	$(61)	$119,688

The following table summarizes the amortized cost, gross unrealized gains and losses, and fair value of available-for-sale investments as of December 31, 2017:

	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Aggregate Fair Value
United States government debt securities	$ 6,000	$—	$(2)	$ 5,998
Certificates of deposit	275	—	—	275
Total	$ 6,275	$—	$(2)	$ 6,273

For more information on the Company's method for determining the fair value of its assets, see Note 2 – "Fair Value of Financial Instruments".

Table of Contents

As of December 31, 2018, all of the available-for-sale investments were due within one year based on their contractual maturities.

Changes in market interest rates and bond yields cause certain investments to fall below their cost basis, resulting in unrealized losses on investments. The unrealized losses of the Company's investments were primarily a result of unfavorable changes in interest rates subsequent to the initial purchase of these investments and were not significant as of December 31, 2018.

As of December 31, 2018 and 2017, the Company did not consider any of its investments to be other-than-temporarily impaired. When evaluating its investments for other-than-temporary impairment, the Company reviews factors such as the length of time and extent to which fair value has been below its cost basis, the financial condition of the issuer, the Company's ability and intent to hold the security and whether it is more likely than not that it will be required to sell the investment before recovery of its cost basis.

7. Investments in Preferred Stock

Investment in ZIOPHARM Preferred Stock

In June 2016, the Company received 100,000 shares of Series 1 Preferred Stock (the "Preferred Shares") of ZIOPHARM with a per share stated value of $1,200, as consideration for amending their two previously existing ECC agreements (Note 5). The Company received a monthly dividend, paid in additional Preferred Shares, equal to $12.00 per Preferred Share held per month divided by the stated value of the Preferred Shares. In conjunction with the ZIOPHARM License Agreement in October 2018 (Note 5), the Company returned to ZIOPHARM all of the Preferred Shares owned or accrued by the Company as of the effective date of the agreement.

The investment in ZIOPHARM preferred stock was categorized as Level 3 as there were significant unobservable inputs and the Preferred Shares were not traded on a public exchange. The fair value of the investment in ZIOPHARM preferred stock was estimated using a probability-weighted expected return ("PWERM") model. The key inputs used in the PWERM model were (i) estimating the future returns for conversion of the Preferred Shares for both product approval and a change in control of ZIOPHARM (the "conversion events") using market data of the change in value for guideline companies as a result of these conversion events; (ii) estimating the expected date and likelihood of each conversion event; and (iii) discounting these estimated future returns using a discount rate for the Preferred Shares considering industry debt issuances originated by public funds and venture capital rates of return. The fair value of the Company's investment in ZIOPHARM preferred stock, including additional Preferred Shares received as dividends, was $160,832 as of December 31, 2017. During the years ended December 31, 2018, 2017 and 2016, the Company received and accrued an additional 11,415, 13,460, and 6,184 Preferred Shares, respectively, and recognized $14,793, $16,717, and $7,421 of dividend income in the accompanying consolidated statements of operations, respectively.

Investment in Fibrocell Preferred Stock

In March 2017, Fibrocell sold Series A Convertible Preferred Stock (the "Convertible Preferred Shares") convertible into shares of Fibrocell common stock and warrants to purchase shares of Fibrocell common stock to certain institutional and accredited investors, including the Company and affiliates of Third Security. The Company paid $1,161 in exchange for 1,161 Convertible Preferred Shares and warrants to acquire 99,769 shares of Fibrocell common stock, reflective of the 1-for-5 reverse stock split of Fibrocell's common stock effective May 25, 2018. The Convertible Preferred Shares are convertible at any time at the election of the Company and accrue dividends at 4% per annum, compounded quarterly, increasing the stated value of the shares. The investment in Fibrocell preferred stock is categorized as Level 3 as there are significant unobservable inputs and the Convertible Preferred Shares are not traded on a public exchange. The fair value of the investment in Fibrocell preferred stock is estimated using a conversion plus dividend approach utilizing the trading value of the underlying common stock and an estimated premium for the preferred stock dividend and other preferences. Market price volatility of Fibrocell's common stock and a significant change in the estimated preferred stock premium could result in a significant impact to the fair value of the investment in Fibrocell preferred stock. As of December 31, 2018 and 2017, the fair value of the Company's investment in Fibrocell preferred stock totaled $191 and $393, respectively. See Note 17 for additional discussion of the warrants.

Investment in Oragenics Preferred Stock

In November 2017, concurrent with Oragenics closing a preferred stock private placement, the Company exchanged a promissory note, including accrued interest, purchased from Oragenics in May 2017 and receivables due from Oragenics totaling $3,385 for Oragenics Series C preferred stock ("Series C Preferred Stock"). The Series C Preferred Stock is non-voting and non-convertible and is redeemable in whole or part at any time by Oragenics in cash. The Series C Preferred Stock accrues

Table of Contents

an annual 12% dividend payable in additional Series C Preferred Stock through May 10, 2019, and after such date, the annual dividend increases to 20%. Additionally, the Company and Oragenics amended certain future payment terms under its ECCs (Note 5). As of December 31, 2018 and 2017, based on the most recent financial information available on Oragenics, the Company concluded that there was no value to its investment in Oragenics preferred stock.

Changes in the Fair Value of Investments in Preferred Stock

The following table summarizes the changes in the Level 3 investments in preferred stock during the years ended December 31, 2018 and 2017.

	2018	2017
Beginning balance	$161,225	$129,545
Purchase of preferred stock	—	766
Conversion of receivables to preferred stock	—	3,385
Dividend income from investments in preferred stock	14,841	16,756
Net unrealized appreciation (depreciation) in the fair value of the investments in preferred stock	(17,499)	10,773
Return of preferred stock	(158,376)	—
Ending balance	$191	$161,225

8. Fair Value Measurements

The carrying amount of cash and cash equivalents, restricted cash, receivables, prepaid expenses and other current assets, accounts payable, accrued compensation and benefits, other accrued liabilities, and related party payables approximate fair value due to the short maturity of these instruments.

Assets

The following table presents the placement in the fair value hierarchy of financial assets that are measured at fair value on a recurring basis, including the items for which the fair value option has been elected, as of December 31, 2018:

	Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	December 31, 2018
Assets				
United States government debt securities	$ —	$ 119,340	$ —	$ 119,340
Equity securities	1,626	556	—	2,182
Preferred stock	—	—	191	191
Other	—	468	—	468
Total	$ 1,626	$ 120,364	$ 191	$ 122,181

Table of Contents

The following table presents the placement in the fair value hierarchy of financial assets that are measured at fair value on a recurring basis, including the items for which the fair value option has been elected, as of December 31, 2017:

	Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	December 31, 2017
Assets				
United States government debt securities	$ —	$ 5,998	$ —	$ 5,998
Equity securities	10,537	4,563	—	15,100
Preferred stock	—	—	161,225	161,225
Other	—	850	—	850
Total	$ 10,537	$ 11,411	$ 161,225	$ 183,173

The method used to estimate the fair value of the Level 1 assets in the tables above is based on observable market data as these equity securities are publicly-traded. The method used to estimate the fair value of the Level 2 short-term investments in the tables above is based on professional pricing sources for identical or comparable instruments, rather than direct observations of quoted prices in active markets. The method used to estimate the fair value of the Level 2 equity securities in the tables above is based on the quoted market price of the publicly-traded security, adjusted for a discount for lack of marketability. The methods used to estimate the fair value of the Level 3 assets are discussed in Note 7.

There were no transfers between levels of the fair value hierarchy during the year ended December 31, 2018.

Liabilities

The carrying values of the Company's long-term debt, excluding the Convertible Notes as discussed below, approximates fair value due to the length of time to maturity and/or the existence of interest rates that approximate prevailing market rates.

The calculated fair value of the Convertible Notes (Note 12) is approximately $141,000 as of December 31, 2018 and is based on the most recent third party trade of the instrument as of the balance sheet date. The fair value of the Convertible Notes are classified as Level 2 within the fair value hierarchy as there is not an active market for the Convertible Notes, however, third party trades of the instrument are considered observable inputs. The Convertible Notes are reflected at amortized cost on the accompanying consolidated balance sheet, which was $148,101 as of December 31, 2018.

The Company's contingent consideration liabilities (Notes 3 and 4) are measured on a recurring basis and were $585 as of December 31, 2018 and 2017. These fair value measurements were based on significant inputs not observable in the market and thus represented a Level 3 measurement. A significant change in unobservable inputs could result in a significant impact on the fair value of the Company's contingent consideration liabilities. The contingent consideration liabilities are remeasured to fair value at each reporting date until the contingencies are resolved, and those changes in fair value are recognized in earnings. The changes in the fair value of the Level 3 liabilities during the years ended December 31, 2018 and 2017 were as follows:

	2018	2017
Beginning balance	$585	$2,081
Acquisition date fair value of contingent consideration liability	—	585
Change in fair value of contingent consideration recognized in selling, general and administrative expenses	—	(2,081)
Ending balance	$585	$585

Table of Contents

9. Inventory

Inventory consists of the following:

	December 31,	
	2018	2017
Supplies, embryos and other production materials	$4,729	$2,673
Work in process	4,391	4,767
Livestock	10,167	11,040
Feed	2,160	2,013
Total inventory	$21,447	$20,493

10. Property, Plant and Equipment, Net

Property, plant and equipment consist of the following:

	December 31,	
	2018	2017
Land and land improvements	$12,490	$11,767
Buildings and building improvements	20,371	18,183
Furniture and fixtures	1,891	2,515
Equipment	74,555	65,863
Leasehold improvements	28,289	25,277
Breeding stock	4,582	3,832
Computer hardware and software	11,697	10,128
Trees	11,910	6,642
Construction and other assets in progress	18,880	14,113
	184,665	158,320
Less: Accumulated depreciation and amortization	(55,791)	(45,646)
Property, plant and equipment, net	$128,874	$112,674

During the year ended December 31, 2018, the Company recorded a $5,057 loss on disposal of certain leasehold improvements, equipment, and other fixed assets in conjunction with the closing of one of its research and development facilities in Brazil. Additionally, included in the table above is $14,219 of land, buildings, and equipment related to a 2017 asset acquisition of a land-based aquaculture facility to be used in the production of AquAdvantage salmon in Indiana.

Depreciation expense was $14,328, $11,951 and $9,387 for the years ended December 31, 2018, 2017 and 2016, respectively.

11. Goodwill and Intangible Assets, Net

The changes in the carrying amount of goodwill for the years ended December 31, 2018 and 2017, are as follows:

	2018	2017
Beginning balance	$153,289	$157,175
Acquisitions	—	4,850
Impairment	—	(13,823)
Foreign currency translation adjustments	(3,704)	5,087
Ending balance	$149,585	$153,289

For the year ended December 31, 2017, the Company recorded a goodwill impairment charge since, based on the price per share received by AquaBounty in its recent underwritten public offering (Note 14), it was more-likely-than-not that the fair value of the AquaBounty reporting unit was less than its carrying amount. As a result, the Company compared the carrying

Table of Contents

amount of the AquaBounty reporting unit to the fair value and determined the carrying amount exceeded the fair value resulting in a $13,001 goodwill impairment charge for the excess carrying value. The Company did not recognize any goodwill impairment charges during the years ended December 31, 2018 or 2016. The Company had $13,823 of accumulated impairment losses as of December 31, 2018.

Intangible assets consist of the following as of December 31, 2018:

	Weighted Average Useful Life (Years)	Gross Carrying Amount	Accumulated Amortization	Net
Patents, developed technologies and know-how	15.5	$152,482	$ (35,133)	$117,349
Customer relationships	6.5	10,700	(7,565)	3,135
Trademarks	9.3	6,800	(3,341)	3,459
In-process research and development		5,348	—	5,348
Total		$175,330	$ (46,039)	$129,291

Intangible assets consist of the following as of December 31, 2017:

	Gross Carrying Amount	Accumulated Amortization	Net
Patents, developed technologies and know-how	$263,615	$ (44,954)	$218,661
Customer relationships	10,700	(6,383)	4,317
Trademarks	6,800	(2,567)	4,233
In-process research and development	5,666	—	5,666
Total	$286,781	$ (53,904)	$232,877

The balance of in-process research and development includes certain in-process research and development technology acquired in the Company's acquisition of Oxitec in September 2015, and amortization will begin once certain regulatory approvals have been obtained for the in-process programs. In the fourth quarter of 2018, the Company recorded an impairment charge of $60,504 due to a change in the Company's business strategy for commercializing the Oxitec developed technology targeting the Aedes Aegypti mosquito, resulting in a lack of projected future cash flows to support the carrying value of the asset. In 2017, the Company recorded an impairment charge of $2,950 as part of its annual impairment assessment of indefinite-lived intangible assets due to the lack of projected future cash flows to support certain in-process research and development.

Additionally, in the fourth quarter of 2018, the Company recorded a $16,027 loss related to the abandonment of certain developed technologies that the Company ceased using in the fourth quarter of 2018. The Company does not expect to use these technologies as a defensive asset or market them for sale in the future. Because these technologies were used in combination with other technologies, the identifiable cash flows did not result in an impairment; however, because the Company made a decision to abandon the assets, it recorded the charge to research and development expense.

Amortization expense was $18,784, $19,194 and $15,185 for the years ended December 31, 2018, 2017 and 2016, respectively. Estimated aggregate amortization expense for definite lived intangible assets is expected to be as follows:

2019	$11,966
2020	11,863
2021	11,675
2022	10,676
2023	9,798
Thereafter	67,965
Total	$123,943

Table of Contents

12. Lines of Credit and Long-Term Debt

Lines of Credit

Trans Ova has a $5,000 revolving line of credit with First National Bank of Omaha that matures on May 1, 2019. The line of credit bears interest at the greater of 2.95% above the London Interbank Offered Rate or 3.00%, and the actual rate was 5.30% as of December 31, 2018. As of December 31, 2018, there was no outstanding balance. The amount available under the line of credit is based on eligible accounts receivable and inventory up to the maximum principal amount. The line of credit is collateralized by certain of Trans Ova's assets and contains certain restricted covenants that include maintaining minimum tangible net worth and working capital and maximum allowable annual capital expenditures. Trans Ova was in compliance with these covenants as of December 31, 2018.

Exemplar has a $700 revolving line of credit with American State Bank that matures on October 30, 2019. The line of credit bears interest at 5.75% per annum. As of December 31, 2018, there was an outstanding balance of $466.

Long-Term Debt

Long-term debt consists of the following:

	December 31,	
	2018	2017
Convertible debt	$203,391	$—
Notes payable	4,551	5,010
Royalty-based financing	2,085	2,132
Other	1,767	895
Long-term debt	211,794	8,037
Less current portion	559	502
Long-term debt, less current portion	$211,235	$7,535

Convertible Debt

Intrexon Convertible Notes

In July 2018, Intrexon completed a registered underwritten public offering of $200,000 aggregate principal amount of Convertible Notes and issued the Convertible Notes under an indenture (the "Base Indenture") between Intrexon and The Bank of New York Mellon Trust Company, N.A., as trustee, as supplemented by the First Supplemental Indenture (together with the Base Indenture, the "Indenture"). Intrexon received net proceeds of $193,958 after deducting underwriting discounts and offering expenses of $6,042.

The Convertible Notes are senior unsecured obligations of Intrexon and bear interest at a rate of 3.50% per year, payable semiannually in arrears on January 1 and July 1 of each year beginning on January 1, 2019. The Convertible Notes mature on July 1, 2023, unless earlier repurchased or converted. The Convertible Notes are convertible into cash, shares of Intrexon's common stock or a combination of cash and shares, at Intrexon's election. The initial conversion rate of the Convertible Notes is 58.6622 shares of Intrexon common stock per $1,000 principal amount of Convertible Notes (equivalent to an initial conversion price of approximately $17.05 per share of common stock). The conversion rate is subject to adjustment upon the occurrence of certain events, but will not be adjusted for any accrued and unpaid interest. In addition, following certain corporate events that occur prior to the maturity date as defined in the Indenture, Intrexon will increase the conversion rate for a holder who elects to convert its Convertible Notes in connection with such a corporate event in certain circumstances. Prior to April 1, 2023, the holders may convert the Convertible Notes at their option only upon the satisfaction of the following circumstances:

- During any calendar quarter commencing after the calendar quarter ending on September 30, 2018, if the last reported sales price of Intrexon's common stock for at least 20 trading days (whether or not consecutive) during the last 30 consecutive trading days of the immediately preceding calendar quarter is greater than or equal to 130% of the conversion price on each applicable trading day;

Table of Contents

- During the five business day period after any five consecutive trading day period in which the trading price, as defined in the Indenture, for the Convertible Notes is less than 98% of the product of the last reported sales price of Intrexon's common stock and the conversion rate for the Convertible Notes on each such trading day; or
- Upon the occurrence of specified corporate events as defined in the Indenture.

None of the above events allowing for conversion prior to April 1, 2023 occurred during the year ended December 31, 2018. On or after April 1, 2023 until June 30, 2023, holders may convert their Convertible Notes at any time. Intrexon may not redeem the Notes prior to the maturity date.

If Intrexon undergoes a fundamental change, as defined in the Indenture, holders of the Convertible Notes may require Intrexon to repurchase for cash all or any portion of their Convertible Notes at a fundamental change repurchase price equal to 100% of the principal amount of the Convertible Notes to be repurchased, plus accrued and unpaid interest to, but excluding, the fundamental change repurchase date. The Indenture contains customary events of default, as defined in the agreement, and, if any of the events occur, could require repayment of a portion or all of the Convertible Notes, including accrued and unpaid interest. Additionally, the Indenture provides that Intrexon shall not consolidate with or merge with or into, or sell, convey, transfer or lease all or substantially all of its properties and assets to, another entity, unless (i) the surviving entity is organized under the laws of the United States and such entity expressly assumes all of Intrexon's obligations under the Convertible Notes and the Indenture; and (ii) immediately after such transaction, no default or event of default has occurred and is continuing under the Indenture.

The net proceeds received from the issuance of the Convertible Notes were initially allocated between long-term debt, the liability component, at $143,723 and additional paid-in capital, the equity component, at $50,235. Additional paid-in capital was further reduced by $13,367 of deferred taxes resulting from the difference between the carrying amount and the tax basis of the Convertible Notes that is created by the equity component, which also resulted in deferred tax benefit recognized from the reversal of valuation allowances on current year domestic operating losses in the same amount (Note 13). As of December 31, 2018, the outstanding principal balance on the Convertible Notes was $200,000 and the carrying value of long-term debt was $148,101. The effective interest rate on the Convertible Notes, including amortization of the long-term debt discount and debt issuance costs, is 11.02%. As of December 31, 2018, the unamortized long-term debt discount and debt issuance costs totaled $51,899.

Total interest expense related to the Convertible Notes was $7,840 for the year ended December 31, 2018, which consists of $3,462 cash interest expense paid in December and $4,378 of noncash interest expense.

ActoBio Convertible Notes

In September 2018, ActoBio issued $30,000 of convertible promissory notes (the "ActoBio Notes") to a related party in conjunction with an asset acquisition with Harvest (Note 3). The ActoBio Notes have a maturity date of September 6, 2020, accrue interest at 3.0% compounded annually, are convertible into shares of ActoBio common stock at any time by the holder, and are automatically convertible in shares of ActoBio common stock upon the closing of certain financing events as defined in the ActoBio Notes. If the ActoBio Notes have not been converted to ActoBio common stock by the maturity date, ActoBio can pay the principal and accrued interest in cash or with shares of Intrexon common stock at its election. There are no embedded features that are required to be separated from the debt host and accounted for separately, so the ActoBio Notes were recorded at $30,000. Interest expense for the year ended December 31, 2018 was $290. As of December 31, 2018, the carrying value of the ActoBio Notes, including accrued interest, was $30,290.

Intrexon and Precigen Convertible Note

In December 2018, in conjunction with the Merck Purchase Agreement (Note 5), Intrexon and Precigen jointly and severally issued a $25,000 convertible note (the "Merck Note") to Ares Trading in exchange for cash. The Merck Note has a maturity date of June 28, 2021 and will be converted to Intrexon common stock on the first trading day following maturity if not otherwise converted prior to that date. Prior to maturity, Ares Trading may convert the Merck Note, at their election, into (i) Intrexon common stock at any time, (ii) Intrexon common stock upon the Company's closing of qualified financing as defined in the agreement, (iii) Precigen equity upon Precigen closing a qualified financing as defined in the agreement, and (iv) Precigen common stock upon the closing of a qualified initial public offering ("IPO") of Precigen common stock. In the event of a conversion upon a qualified IPO, the conversion price will be 90% of the IPO price. In the event Ares Trading elects to convert the Merck Note into Precigen equity,

the Merck Note accrues interest at a rate of 5% per year ("PIK interest") and will be converted with the outstanding principal. The Company determined that the potential PIK interest and IPO conversion

Table of Contents

discount represented embedded derivatives requiring bifurcation from the debt host but had no significant value as of December 31, 2018.

Notes Payable

Trans Ova has a note payable to American State Bank that matures in April 2033 and has an outstanding principal balance of $4,482 as of December 31, 2018. Trans Ova pays monthly installments of $39, which includes interest at 3.95%. The note payable is collateralized by certain of Trans Ova's real estate and non-real estate assets.

Royalty-based Financing

AquaBounty has a royalty-based financing grant from the Atlantic Canada Opportunities Agency, a Canadian government agency, to provide funding of a research and development project. The total amount available under the award was $2,107, which AquaBounty claimed over a five year period. All amounts claimed by AquaBounty must be repaid in the form of a 10% royalty on any products commercialized out of this research and development project until fully paid. Because the timing of commercialization is subject to additional regulatory considerations, the timing of repayment is uncertain. As of the date of the acquisition by Intrexon in March 2013, AquaBounty had claimed $1,952 of the available funds and this amount was recorded at its acquisition date fair value of $1,107. The Company accretes the difference of $845 between the face value of amounts drawn and the acquisition date fair value over the expected period of repayment. Subsequent to the acquisition date, AquaBounty claimed the remaining balance available under the grant, resulting in total long term debt of $2,085 as of December 31, 2018.

Future Maturities

Future maturities of long-term debt are as follows:

2019	$559
2020	30,843
2021	25,405
2022	420
2023	201,442
Thereafter	2,939
Total	$261,608

The AquaBounty royalty-based financing grant is not included in the table above due to the uncertainty of the timing of repayment.

13. Income Taxes

The components of loss before income taxes are presented below:

	Year Ended December 31,		
	2018	2017	2016
Domestic	$(443,337)	$(71,343)	$(157,067)
Foreign	(92,897)	(58,357)	(37,084)
Loss before income taxes	$(536,234)	$(129,700)	$(194,151)

Table of Contents

The components of income tax expense (benefit) are presented below:

	Year Ended December 31,		
	2018	2017	2016
United States federal income taxes:			
Current	$(31)	$27	$(17)
Deferred	(11,855)	(523)	1,396
Foreign income taxes:			
Current	(332)	(379)	(393)
Deferred	(5,068)	(2,269)	(5,177)
State income taxes:			
Current	113	—	—
Deferred	(4,355)	264	314
Income tax benefit	$(21,528)	$(2,880)	$(3,877)

Income tax benefit for the years ended December 31, 2018, 2017 and 2016 differed from amounts computed by applying the applicable United States federal corporate income tax rate of 21% for 2018, and 34% for years prior to 2018, to loss before income taxes as a result of the following:

	2018	2017	2016
Computed statutory income tax benefit	$(112,609)	$(44,098)	$(66,011)
State and provincial income tax benefit, net of federal income taxes	(24,724)	(3,294)	(7,905)
Nondeductible stock based compensation	1,834	4,147	3,321
Nondeductible officer compensation	294	476	—
Gain on dividend distribution of AquaBounty common stock	—	3,965	—
Impairment of goodwill	—	4,700	—
Research and development tax incentives	(1,088)	(1,166)	(6,350)
Acquisition and internal restructuring transaction costs	52	354	571
Provisional impact of the Tax Act	—	85,288	—
Enacted changes in foreign tax rates and foreign tax reforms	—	2,138	—
Reacquired in-process research and development	2,696	—	—
Change in deferred state tax rate	8,666	—	—
United States-foreign rate differential	3,017	5,410	3,463
Other, net	(486)	(64)	1,485
	(122,348)	57,856	(71,426)
Change in valuation allowance for deferred tax assets	100,820	(60,736)	67,549
Total income tax benefit	$(21,528)	$(2,880)	$(3,877)

Table of Contents

The tax effects of temporary differences that comprise the deferred tax assets and liabilities as of December 31, 2018 and 2017, are as follows:

	2018	2017
Deferred tax assets		
Allowance for doubtful accounts	$1,490	$1,300
Inventory	614	489
Equity securities and investments in affiliates	30,241	17,510
Intangible assets	71,205	—
Accrued liabilities	4,412	3,131
Stock-based compensation	29,297	26,936
Deferred revenue	16,297	61,785
Research and development tax credits	11,597	11,385
Net operating and capital loss carryforwards	148,411	111,453
Total deferred tax assets	313,564	233,989
Less: Valuation allowance	308,113	215,582
Net deferred tax assets	5,451	18,407
Deferred tax liabilities		
Property, plant and equipment	528	237
Intangible assets	—	33,790
Long-term debt	12,136	—
Total deferred tax liabilities	12,664	34,027
Net deferred tax liabilities	$(7,213)	$(15,620)

Activity within the valuation allowance for deferred tax assets during the years ended December 31, 2018, 2017 and 2016 was as follows:

	2018	2017	2016
Valuation allowance at beginning of year	$215,582	$256,165	$190,174
Increase (decrease) in valuation allowance as a result of			
Mergers and acquisitions, net	418	—	(1,416)
Current year operations	122,853	26,619	67,549
Adoption of ASC 606	(7,477)	—	—
Adoption of ASU 2016-09	—	17,843	—
Provisional impact of the Tax Act	—	(87,473)	—
Equity component of long-term debt	(13,367)	—	—
Change in deferred state tax rate	(8,666)	—	—
Changes in foreign tax rates and foreign tax reforms	—	1,327	—
Foreign currency translation adjustment	(1,230)	1,101	(142)
Valuation allowance at end of year	$308,113	$215,582	$256,165

In assessing the realizability of deferred tax assets, management considers whether it is more likely than not that some portion or all of the deferred tax assets will not be realized. The ultimate realization of deferred tax assets is dependent upon the generation of future taxable income during the periods in which those temporary differences become deductible. Management considers the scheduled reversal of deferred tax liabilities, projected future taxable income and tax planning strategies in making this assessment. Due to the Company and its subsidiaries' histories of net losses incurred from inception, any corresponding net domestic and certain foreign deferred tax assets have been fully reserved as the Company and its subsidiaries cannot sufficiently be assured that these deferred tax assets will be realized. The components of the deferred tax assets and liabilities as of the date of the mergers and acquisitions by the Company prior to consideration of the valuation allowance are substantially similar to the components of deferred tax assets presented herein.

Table of Contents

The Company's past issuances of stock and mergers and acquisitions have resulted in ownership changes as defined in Section 382 of the Internal Revenue Code of 1986, as amended ("Section 382"). As a result, utilization of portions of the net operating losses may be subject to annual limitations, however as of December 31, 2018, all such limited losses applicable to Intrexon, other than losses inherited via acquisition, have been fully utilized. As of December 31, 2018, approximately $41,909 of the Company's domestic net operating losses were inherited via acquisition, including $13,376 acquired via the acquisition of GenVec, and are limited based on the value of the target at the time of the transaction.

As of December 31, 2018, the Company has loss carryforwards for United States federal income tax purposes of approximately $369,102 available to offset future taxable income, including $116,600 generated after 2017, and federal and state research and development tax credits of $7,881, prior to consideration of annual limitations that may be imposed under Section 382. Carryforwards generated prior to 2018 will begin to expire in 2022. The Company's direct foreign subsidiaries have foreign loss carryforwards of approximately $159,811, most of which do not expire. The Company does not record deferred taxes on the undistributed earnings of its direct foreign subsidiaries because it does not expect the temporary differences related to those unremitted earnings to reverse in the foreseeable future. As of December 31, 2018, the Company's direct foreign subsidiaries had accumulated deficits of approximately $150,409. Future distributions of accumulated earnings of the Company's direct foreign subsidiaries may be subject to United States income and foreign withholding taxes.

The Company does not file a consolidated income tax return with AquaBounty. As of December 31, 2018, AquaBounty has loss carryforwards for federal and foreign income tax purposes of approximately $37,807, including $9,370 generated after 2017, and $14,007, respectively, and foreign tax credits of approximately $2,628 available to offset future taxable income, prior to consideration of annual limitations that may be imposed under Section 382 or analogous foreign provisions. Carryforwards generated prior to 2018 began to expire in 2018. As a result of the Company's ownership in AquaBounty passing 50% in 2013, an annual Section 382 of approximately $900 per year will apply to domestic losses and credits carried forward by AquaBounty from prior years, which are also subject to prior Section 382 limitations.

In the year ended December 31, 2017, the Company recorded a net provisional income tax benefit of $2,185 upon enactment of the Tax Act, which is comprised of several items. Amounts related to the remeasurement of most of the Company's domestic deferred tax assets as a result of the United States corporate rate change to 21% as part of the Tax Act are $87,473, which was fully offset by a reduction in the Company's valuation allowance. The Company's net United States deferred tax liability that is not offset by a valuation allowance was similarly written down, and the Company recorded a provisional deferred tax benefit of $1,730. The Company also recorded a provisional current tax benefit of $455 related to the expected refundability of accumulated corporate alternative minimum tax credits. The Company provisionally estimated its transition tax exposure to be zero, as any accumulated earnings in foreign subsidiaries are offset by accumulated deficits in other foreign subsidiaries. The Company completed its accounting for the Tax Act in the fourth quarter of 2018, and there were no significant adjustments to the previously recorded provisional amounts.

Additionally, in December 2017, Belgium enacted significant tax reform measures, the most significant of which to the Company is the limitation on the utilization of accumulated losses in years after 2017. After that date, loss carryforwards can only be used to offset 70% of taxable income that exceeds a certain threshold. As a result, the Company recorded adjustments to its net deferred tax assets and valuation allowances. These adjustments resulted in a net deferred tax liability of $2,307, which was recorded as a component of deferred tax expense for the year ended December 31, 2017.

The Company and its subsidiaries do not have material unrecognized tax benefits as of December 31, 2018. The Company does not anticipate significant changes in the amount of unrecognized tax benefits in the next 12 months. The Company's tax returns for years 2004 and forward are subject to examination by federal or state tax authorities due to the carryforward of unutilized net operating losses and research and development tax credits.

14. Shareholders' Equity

Issuances of Intrexon Common Stock

In January 2018, Intrexon closed a public offering of 6,900,000 shares of its common stock, including 1,000,000 shares of common stock purchased by affiliates of Third Security. The net proceeds of the offering were $82,374, after deducting underwriting discounts of $3,688 and offering expenses of $188, all of which were capitalized.
In December 2017, the Company entered into a securities purchase agreement with an affiliate of Third Security for the private placement of 1,207,980 shares of the Company's common stock for gross proceeds of $13,686.

Table of Contents

Share Lending Agreement

Concurrently with the offering of the Convertible Notes (Note 12), Intrexon entered into a share lending agreement (the "Share Lending Agreement") with J.P. Morgan Securities LLC (the "Share Borrower") pursuant to which Intrexon loaned and delivered 7,479,431 shares of its common stock (the "Borrowed Shares") to the Share Borrower. The Share Lending Agreement will terminate, and the Borrowed Shares will be returned to Intrexon within five business days of such termination, upon (i) termination by the Share Borrower or (ii) the earliest to occur of (a) October 1, 2023 and (b) the date, if any, on which the Share Lending Agreement is either mutually terminated or terminated by one party upon a default by the other party. The Borrowed Shares were offered and sold to the public at a price of $13.37 per share under a registered offering (the "Borrowed Shares Offering"). Intrexon did not receive any proceeds from the sale of the Borrowed Shares to the public. The Share Borrower or its affiliates received all the proceeds from the sale of the Borrowed Shares to the public. Affiliates of Third Security purchased all of the shares of common stock in the Borrowed Shares Offering.

The Share Lending Agreement was entered into at fair value and met the requirements for equity classification. Therefore, the value is netted against the issuance of the Borrowed Shares in additional paid-in capital. Additionally, the Borrowed Shares are not included in the denominator for loss per share attributable to Intrexon shareholders unless the Share Borrower defaults on the Share Lending Agreement.

Issuances of AquaBounty Common Stock

In January 2018, AquaBounty completed an underwritten public offering that resulted in net proceeds of $10,616 after deducting discounts, fees and expenses. As part of this offering, Intrexon purchased $5,000 of additional AquaBounty common stock. In October 2018, certain investors exercised warrants acquired from the January 2018 offering, resulting in additional net proceeds of $4,316, including $3,077 from Intrexon.

In January 2017, in conjunction with the listing by AquaBounty of their common stock on the NASDAQ Stock Market, Intrexon purchased $25,000 of additional AquaBounty common stock and subsequently distributed shares of AquaBounty common stock as a dividend to Intrexon shareholders.

Dividends to Shareholders

In January 2017, the Company distributed to its shareholders 1,776,557 shares of AquaBounty common stock valued at $22,385. The distribution constituted a dividend to shareholders of record as of January 9, 2017. In connection with the distribution and pursuant to the terms of the Company's equity incentive plans, the conversion terms of all outstanding options for shares of the Company's common stock as of January 9, 2017 were adjusted to reflect the value of the distribution with respect to shares of the Company's common stock by decreasing the exercise prices and increasing the number outstanding options. This adjustment resulted in 46,766 additional outstanding options at a weighted average exercise price of $31.11.

Components of Accumulated Other Comprehensive Loss

The components of accumulated other comprehensive loss are as follows:

	December 31,	
	2018	2017
Unrealized loss on investments	$(61)	$(2)
Loss on foreign currency translation adjustments	(28,551)	(15,552)
Total accumulated other comprehensive loss	$(28,612)	$(15,554)

15. Share-Based Payments

The Company records the fair value of stock options and RSUs issued to employees and nonemployees as of the grant date as stock-based compensation expense. Stock-based compensation expense for employees and nonemployees is recognized over the requisite service period, which is typically the vesting period. Stock-based compensation costs included in the consolidated statements of operations are presented below:

Table of Contents

	Year Ended December 31,		
	2018	2017	2016
Cost of products	$78	$116	$81
Cost of services	237	322	274
Research and development	9,676	9,336	9,251
Selling, general and administrative	26,305	31,802	32,596
Total	$36,296	$41,576	$42,202

Intrexon Stock Option Plans

In April 2008, Intrexon adopted the 2008 Equity Incentive Plan (the "2008 Plan") for employees and nonemployees pursuant to which Intrexon's board of directors granted share based awards, including stock options, to officers, key employees and nonemployees. Upon the effectiveness of the 2013 Omnibus Incentive Plan (the "2013 Plan"), no new awards may be granted under the 2008 Plan. As of December 31, 2018, there were 410,909 stock options outstanding under the 2008 Plan.

Intrexon adopted the 2013 Plan for employees and nonemployees pursuant to which Intrexon's board of directors may grant share-based awards, including stock options, and shares of common stock, to employees, officers, consultants, advisors, and nonemployee directors. The 2013 Plan became effective in August 2013, and as of December 31, 2018, there were 20,000,000 shares authorized for issuance under the 2013 Plan, of which 10,682,154 stock options and 970,341 RSUs were outstanding and 5,086,700 shares were available for grant.

Stock options may be granted with an exercise price equal to or greater than the stock's fair market value at the date of grant. Stock options may be granted with an exercise price less than the stock's fair market value at the date of grant if the stock options are replacement options in accordance with certain United States Treasury regulations. Virtually all stock options have ten-year terms and vest four years from the date of grant.

Stock option activity was as follows:

	Number of Shares	Weighted Average Exercise Price	Weighted Average Remaining Contractual Term (Years)
Balances at December 31, 2015	11,043,528	$ 32.66	8.49
Granted	4,644,860	29.39	
Exercised	(1,210,840)	(15.83)	
Forfeited	(2,760,809)	(40.34)	
Expired	(76,356)	(37.81)	
Balances at December 31, 2016	11,640,383	31.25	8.21
Granted	3,920,950	21.47	
Adjustment due to dividend (Note 14)	46,766	31.11	
Exercised	(149,429)	(6.37)	
Forfeited	(3,797,105)	(28.37)	
Expired	(278,818)	(33.18)	
Balances at December 31, 2017	11,382,747	28.99	7.32
Granted	1,470,339	14.26	
Exercised	(45,159)	(6.59)	
Forfeited	(929,596)	(21.48)	
Expired	(785,268)	(26.25)	
Balances at December 31, 2018	11,093,063	27.95	6.81
Exercisable at December 31, 2018	7,002,519	30.37	5.97

Table of Contents

Total unrecognized compensation costs related to unvested awards as of December 31, 2018 were $37,353, and are expected to be recognized over a weighted-average period of approximately two years.

The weighted average grant date fair value of options granted during 2018, 2017 and 2016 was $7.94, $12.19 and $16.28, respectively. The aggregate intrinsic value of options exercised during 2018, 2017 and 2016 was $356, $2,429 and $22,704, respectively. The aggregate intrinsic value of options is calculated as the difference between the exercise price of the underlying options and the fair value of Intrexon's common stock for those shares where the exercise price was lower than the fair value of Intrexon's common stock on the date of exercise.

The following table summarizes additional information about stock options outstanding as of December 31, 2018:

	Options Outstanding				Options Exercisable			
Range of Exercise Prices	Number of Options	Weighted Average Exercise Price	Weighted Average Remaining Life (Years)	Aggregate Intrinsic Value	Number of Options	Weighted Average Exercise Price	Weighted Average Remaining Life (Years)	Aggregate Intrinsic Value
$3.17 – $19.52	1,973,818	$ 13.70	7.54	$ 169	833,007	$ 12.80	4.85	$ 169
$19.85 – $20.94	1,914,763	20.93	7.99	—	500,263	20.92	7.67	—
$21.00 – $27.08	2,057,126	23.29	7.26	—	1,248,370	23.01	6.69	—
$27.10 – $29.56	2,666,109	29.19	5.28	—	2,593,151	29.20	5.23	—
$29.58 – $65.08	2,481,247	47.24	6.59	—	1,827,728	47.65	6.54	—
	11,093,063	$ 27.95	6.81	$ 169	7,002,519	$ 30.37	5.97	$ 169

The following table summarizes additional information about stock options outstanding as of December 31, 2017:

	Options Outstanding				Options Exercisable			
Range of Exercise Prices	Number of Options	Weighted Average Exercise Price	Weighted Average Remaining Life (Years)	Aggregate Intrinsic Value	Number of Options	Weighted Average Exercise Price	Weighted Average Remaining Life (Years)	Aggregate Intrinsic Value
$2.64 – $9.30	453,371	$ 7.06	3.94	$ 2,020	453,371	$ 7.06	3.94	$ 2,020
$12.50 – $21.38	3,158,121	20.58	8.74	—	456,942	19.52	7.13	—
$21.43 – $28.81	3,399,721	25.55	6.91	—	1,804,401	25.86	5.69	—
$28.88 – $40.99	2,751,716	32.07	6.70	—	1,732,250	31.51	6.32	—
$41.41 – $65.08	1,619,818	53.52	7.42	—	859,733	53.07	7.38	—
	11,382,747	$ 28.99	7.32	$ 2,020	5,306,697	$ 29.96	6.14	$ 2,020

RSU activity was a follows:

	Number of Restricted Stock Units	Weighted Average Grant Date Fair Value	Weighted Average Remaining Contractual Term (Years)
Balances at December 31, 2017	—	$ —	0.00
Granted	1,069,126	13.84	
Vested	(25,000)	(15.82)	
Forfeited	(73,785)	(13.47)	
Balances at December 31, 2018	970,341	13.82	1.43

Total unrecognized compensation costs related to unvested RSU awards as of December 31, 2018 were $9,641, and are expected to be recognized over a weighted-average period of approximately three years.

Table of Contents

Intrexon currently uses authorized and unissued shares to satisfy share award exercises.

The Company's Chief Executive Officer ("CEO") receives a base salary of $200 per month payable in fully vested shares of Intrexon common stock with such shares subject to a three-year lock-up on resale. The monthly number of shares of common stock is calculated based on the closing price on the last trading day of each month and the shares are issued pursuant to the terms of a Restricted Stock Unit Agreement ("RSU Agreement") between Intrexon and the CEO pursuant to the terms of the 2013 Plan. The RSU Agreement expires March 31, 2019 and is subject to renewal annually by the compensation committee of the board of directors of the Company. The fair value of the shares issued as compensation for services is included in selling, general, and administrative expenses in the Company's consolidated statements of operations and totaled $1,956, $1,908, and $1,861 for the years ended December 31, 2018, 2017 and 2016, respectively.

AquaBounty Stock Option Plans

In March 2016, AquaBounty's board of directors adopted the AquaBounty 2016 Equity Incentive Plan ("AquaBounty 2016 Plan") to replace the AquaBounty 2006 Equity Incentive Plan ("AquaBounty 2006 Plan"). The AquaBounty 2016 Plan provides for the issuance of incentive stock options, non-qualified stock options and awards of restricted and direct stock purchases to directors, officers, employees, and consultants of AquaBounty. The AquaBounty 2016 Plan was approved by AquaBounty's shareholders at its annual meeting in April 2016. Upon the effectiveness of the AquaBounty 2016 Plan, no new awards may be granted under the AquaBounty 2006 Plan.

As of December 31, 2018, there were 339,964 options outstanding under both AquaBounty plans, of which 303,986 were exercisable, at a weighted average exercise price of $7.09 per share. As of December 31, 2017, there were 227,203 options outstanding under these plans, of which 192,748 were exercisable, at a weighted average exercise price of $9.39 per share.

16. Commitments and Contingencies

Operating Leases

The Company leases certain facilities and equipment under noncancelable operating leases. The equipment leases are renewable at the option of the Company. As of December 31, 2018, future minimum lease payments under operating leases having initial or remaining noncancelable lease terms in excess of one year are as follows:

2019	$9,182
2020	9,910
2021	9,127
2022	8,305
2023	7,229
Thereafter	34,157
Total	$77,910

Rent expense, including other facility expenses, was $13,076, $11,064 and $8,593 in 2018, 2017 and 2016, respectively.

Purchase Commitments

As of December 31, 2018, the Company had outstanding contractual purchase commitments of $20,055, which primarily relate to amounts that will be paid in 2019 and 2020 upon delivery of commercial non-browning apple trees.

Contingencies

In March 2012, Trans Ova was named as a defendant in a licensing and patent infringement suit brought by XY, LLC ("XY") alleging that certain of Trans Ova's activities breached a 2004 licensing agreement and infringed on patents that XY allegedly owned. Trans Ova filed a number of counterclaims in the case. In Colorado District Court, the matter proceeded to a jury trial in January 2016. The jury determined that XY and Trans Ova had each breached the licensing agreement and that Trans Ova had infringed XY's patents. In April 2016, the court issued its post-trial order, awarding $528 in damages to Trans Ova and $6,066 in damages to XY. The order also provided Trans Ova with a compulsory license to XY's technology, subject to an ongoing royalty obligation. Both parties appealed the district court's order, which appeal was decided in May 2018 by the Court of Appeals for the Federal Circuit. The Court denied Trans Ova's appeal of its claims for antitrust, breach of contract and patent

Table of Contents

invalidity (except as to one patent, for which the Court affirmed invalidity in a separate, same-day ruling in a third-party case). The Court considered the issue of willfulness to be moot since the district court did not award damages for the willfulness finding. Finally, the Court remanded the district court's calculation of the ongoing royalty and instructed the district court to re-calculate the ongoing royalty in light of post-verdict economic factors.

Since the inception of the 2004 agreement, Trans Ova has remitted payments to XY pursuant to the terms of that agreement, or pursuant to the terms of the April 2016 court order, and has recorded these payments in cost of services in the consolidated statements of operations for the respective periods. For the period from inception of the 2004 agreement through the court's April 2016 order, aggregate royalty and license payments were $3,170, of which $2,759 had not yet been deposited by XY. In the year ended December 31, 2016, the Company recorded expense of $4,228, which is included in selling, general and administrative expenses on the accompanying consolidated statement of operations, representing the excess of the net damages awarded to XY, including prejudgment interest, over the liability previously recorded by Trans Ova for uncashed checks previously remitted to XY. In August 2016, Trans Ova deposited the net damages amount, including prejudgment interest, into the court's treasury, to be held until the appeals process is complete and final judgment amounts are determined. As of December 31, 2018, this amount is included in restricted cash on the accompanying consolidated balance sheet. In December 2016, Trans Ova elected to void the outstanding checks discussed above, and these amounts have been reclassified to other accrued liabilities on the accompanying consolidated balance sheets as of December 31, 2018 and 2017.

In December 2016, XY filed a complaint for patent infringement and trade secret misappropriation against Trans Ova in the District Court of Waco, Texas. Since the claims in this 2016 complaint directly relate to the 2012 licensing dispute and patent issues, Trans Ova filed and was granted a motion for change of venue to Colorado District Court. Trans Ova also filed a motion to dismiss, from which the Court dismissed ten of the twelve counts of the complaint. Presently, two counts for patent infringement remain pending. Trans Ova and the Company could elect to enter into a settlement agreement in order to avoid the further costs and uncertainties of litigation.

The Company may become subject to other claims, assessments and governmental investigations from time to time in the ordinary course of business. Such matters are subject to many uncertainties and outcomes are not predictable with assurance. The Company accrues liabilities for such matters when it is probable that future expenditures will be made and such expenditures can be reasonably estimated. As of December 31, 2018 and 2017, the Company does not believe that any such matters, individually or in the aggregate, will have a material adverse effect on the Company's business, financial condition, results of operations, or cash flows.

17. Related Party Transactions

Third Security and Affiliates

The Company's CEO and Chairman of the board of directors is also the Senior Managing Director and CEO of Third Security and owns 100% of the equity interests of Third Security. In November 2015, the independent members of Intrexon's board of directors, with the recommendation of the audit committee of the board of directors, approved the execution of a Services Agreement ("Services Agreement") with Third Security pursuant to which Third Security provides the Company with certain professional, legal, financial, administrative, and other support services necessary to support the Company and its CEO. As consideration for providing these services, Third Security is entitled to a fee of $800 per month to be paid in the form of fully-vested shares of the Company's common stock. The number of shares of common stock is calculated based on the closing price of the Company's common stock on the 15th day of each month. The payments made by the Company under the Services Agreement constitute, in the aggregate, an award under the 2013 Plan and are subject to the terms of the 2013 Plan (Note 15). The Services Agreement had a term of one year, can be terminated by the Company at any time, and may be extended only by agreement of the parties, including approval of a majority of the independent members of Intrexon's board of directors. The independent members of Intrexon's board of directors, with the recommendation of the audit committee of the board of directors, subsequently approved extensions of the Services Agreement through January 1, 2019. For the years ended December 31, 2018, 2017 and 2016, the Company issued 696,033 shares, 500,650 shares, and 337,163 shares, respectively, with values of $8,324, $8,704, and $8,571, respectively, to Third Security as payment for services pursuant to the Services Agreement. In addition to the foregoing Services Agreement, the Company reimburses Third Security for certain out-of-pocket expenses incurred on the Company's behalf, and the total expenses incurred by the

Company under this arrangement was $47, $409, and $309 for the years ended December 31, 2018, 2017 and 2016, respectively.

See also Note 15 regarding compensation arrangements between the Company and its CEO.

In October 2017, the Company entered into a Preferred Stock Equity Facility ("Preferred Stock Equity Facility") with an affiliate of Third Security ("Third Security Affiliate"). Under the Preferred Stock Equity Facility, the Company could, from

Table of Contents

time to time at its sole and exclusive option, issue and sell to the Third Security Affiliate, up to $100,000 of newly issued Series A Redeemable Preferred Stock ("Series A Preferred Stock"). In conjunction with the Company's July 2018 registered underwritten public offering of Convertible Notes (Note 12), the Preferred Stock Equity Facility was terminated. No shares of Series A Preferred Stock had been issued under the Preferred Stock Equity Facility.

The Company also subleases certain administrative offices to Third Security. The significant terms of the lease mirror the terms of the Company's lease with the landlord, and the Company recorded sublease income of $89, $43, and $43 for the years ended December 31, 2018, 2017 and 2016, respectively.

Transactions with ECC Parties

In addition to entities controlled by Third Security, any entity in which the Company holds equity securities, including securities received as upfront or milestone consideration, and that also are party to a collaboration with the Company are considered to be related parties.

During 2018, the Company mutually terminated each of its ECC agreements with Histogenics Corporation ("Histogenics"), OvaScience, and Synthetic Biologics, Inc. ("Synthetic Biologics"). Upon termination of these ECCs, the Company recognized the remaining deferred revenue totaling $11,877.

In December 2017, the Company purchased certain property and equipment comprising the pilot plant production facility for its energy programs for $2,812 from Intrexon Energy Partners. The Company intends to use the pilot plant to support the collaborations with Intrexon Energy Partners and Intrexon Energy Partners II and its own research programs.

The Company holds a promissory note convertible into shares of Fibrocell common stock ("convertible note") and warrants to purchase shares of Fibrocell common stock. As of December 31, 2018 and 2017, the value of the convertible note and warrants totaled $120 and $575, respectively, and is included in other assets on the accompanying consolidated balance sheets.

In June 2016, the Company purchased 226,142 shares of Oragenics common stock at $5.20 per share.

In December 2016, the Company sold all of its investment in AmpliPhi Biosciences Corporation common stock, resulting in a realized loss of $4,098, which is included in unrealized and realized depreciation in fair value of equity securities on the consolidated statement of operations for the year ended December 31, 2016.

Other Related Parties

In June 2015, the Company entered into an agreement with Harvest, an investment fund sponsored by Harvest Capital Strategies, LLC, and a related party based on ownership in the fund by affiliates of Third Security. Harvest was established to invest in life science research and development start-up opportunities that the Company offered to Harvest with exclusive rights of first-look and first negotiation. Based on this agreement, Harvest established six new collaboration entities, each of which entered into an ECC with the Company in a designated field. The terms of such ECCs were negotiated between the Company and Harvest. As consideration for providing exclusive rights of first-look and first negotiation for start-up opportunities, the Company received a portion of the management fee collected by the fund sponsor of Harvest. These fees are included in other income in the accompanying consolidated statements of operations and totaled $1,839 and $2,483 for the years ended December 31, 2017 and 2016, respectively. In September 2017, the commitment period for Harvest was terminated and, as a result, the agreement with Harvest terminated. The termination of the agreement had no effect on the existing collaborations with Harvest-controlled entities. See Note 3 for further discussion of the asset acquisition of certain Harvest entities.

Table of Contents

18. Net Loss per Share

The following table presents the computation of basic and diluted net loss per share:

	2018	2017	2016
Historical net loss per share:			
Numerator:			
Net loss attributable to Intrexon	$(509,336)	$(117,018)	$(186,612)
Denominator:			
Weighted average shares outstanding, basic and diluted	129,521,731	119,998,826	117,983,836
Net loss attributable to Intrexon per share, basic and diluted	$(3.93)	$(0.98)	$(1.58)

The following potentially dilutive securities as of December 31, 2018, 2017, and 2016, have been excluded from the above computations of diluted weighted average shares outstanding for the years then ended as they would have been anti-dilutive:

	December 31,		
	2018	2017	2016
Convertible debt	18,955,668	—	—
Options	11,093,063	11,382,747	11,640,383
Restricted stock units	970,341	—	—
Warrants	133,264	133,264	—
Total	31,152,336	11,516,011	11,640,383

19. Quarterly Financial Information (Unaudited)

The following information has been derived from unaudited consolidated statements that, in the opinion of management, include all recurring adjustments necessary for a fair statement of such information.

	Three Months Ended			
	March 31, 2018	June 30, 2018	September 30, 2018	December 31, 2018 (1)
Total revenues	$39,666	$45,275	$ 32,448	$43,185
Operating loss	(52,522)	(49,735)	(66,471)	(336,882)
Net loss	(47,409)	(66,829)	(58,746)	(341,722)
Net loss attributable to Intrexon	(46,165)	(65,382)	(57,324)	(340,465)
Net loss attributable to Intrexon per share, basic and diluted	$(0.36)	$(0.51)	$ (0.44)	$(2.59)

(1) During the fourth quarter of 2018, the Company reacquired certain in-process research and development from ZIOPHARM, Ares Trading, and Intrexon T1D Partners, all of which were immediately expensed (Notes 4 and 5). The Company also recorded an intangible asset impairment charge and a loss on abandonment of certain of its intangible assets (Note 11). The Company also recognized the remaining balance of deferred revenue associated with Histogenics and Synthetic Biologics upon the mutual termination of the ECCs with these entities (Note 17).

Table of Contents

	Three Months Ended			
	March 31, 2017	June 30, 2017	September 30, 2017	December 31, 2017 (1)
Total revenues	$53,504	$54,433	$ 46,016	$77,028
Operating loss	(31,381)	(35,270)	(44,747)	(26,492)
Net loss	(32,377)	(19,662)	(40,836)	(33,945)
Net loss attributable to Intrexon	(31,399)	(18,664)	(39,689)	(27,266)
Net loss attributable to Intrexon per share, basic and diluted	$(0.26)	$(0.16)	$ (0.33)	$(0.23)

(1) During the fourth quarter of 2017, the Company recognized the remaining balance of deferred revenue associated with ZIOPHARM ECC2 upon the parties' mutual agreement to terminate (Note 5). The Company also recorded goodwill impairment charges primarily related to the AquaBounty reporting unit and an impairment charge related to certain of its in-process research and development assets (Note 11).

20. Defined Contribution Plans

The Company sponsors defined contribution plans covering employees who meet certain eligibility requirements. The Company makes contributions to the plans in accordance with terms specified in the plan agreement. The Company's contributions to the plans were $2,493, $2,367 and $1,857 in 2018, 2017 and 2016, respectively.