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

FORM 10-K

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

For the fiscal year ended December 31, 2022

OR

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

For the transition period from _____ to _____.

Commission file number:

001-36042

PRECIGEN, INC.

(Exact name of registrant as specified in its charter)

Virginia

(State or other jurisdiction of
incorporation or organization)

26-0084895

(I.R.S. Employer
Identification Number)

20374 Seneca Meadows Parkway

Germantown, Maryland

(Address of principal executive offices)

20876

(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	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, No Par Value	PGEN	Nasdaq Global Select Market

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

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

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

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

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

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

Large accelerated filer	<input type="checkbox"/>	Accelerated filer	<input checked="" type="checkbox"/>
Non-accelerated filer	<input type="checkbox"/>	Smaller reporting company	<input type="checkbox"/>
		Emerging growth company	<input type="checkbox"/>

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

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

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

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements. Yes No

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b). Yes No

As of June 30, 2022, the last business day of the registrant's most recently completed second fiscal quarter, the aggregate market value of the registrant's common stock held by non-affiliates based upon the closing price of such shares on the Nasdaq Global Select Market on such date was approximately \$162.1 million.

As of February 15, 2023, 252,194,713 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 2023 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, 2022.

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Intrexon[®], UltraCAR-T[®], RheoSwitch[®], UltraVector[®], RTS[®], UltraPorator[®], ActoBiotics[®] and RheoSwitch Therapeutic System[®] are our and/or our affiliates' registered trademarks in the United States and GenVec[™], Precigen[™], AdenoVerse[™], ActoBio Therapeutics[™], AttSite[™], and Precigen Therapeutics[™] are our and/or our affiliates' common law trademarks in the United States 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 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 "Precigen", "we", "us", and "our" refer to Precigen, Inc.

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, including statements regarding our strategy; future events, including their outcome or timing; future operations; future financial position; future revenue; projected costs; prospects; plans; objectives of management; and expected market growth, are forward-looking statements. The words "aim", "anticipate", "assume", "believe", "continue", "could", "due", "estimate", "expect", "intend", "may", "objective", "plan", "positioned", "potential", "predict", "project", "seek", "should", "target", "will", "would", and the negatives of these terms or similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words. These statements may relate to, among other things: (i) the impact of the COVID-19 pandemic on our clinical trials, businesses, operating results, cash flows, and/or financial condition; (ii) the timeliness of regulatory approvals; (iii) our strategy and overall approach to our business model, our efforts to realign our business, and our ability to exercise more control and ownership over the development process and commercialization path; (iv) our ability to successfully enter new markets or develop additional product candidates, including the expected timing and results of investigational studies and preclinical and clinical trials, whether with our collaborators or independently; (v) our ability to consistently manufacture our product candidates on a timely basis or to establish agreements with third-party manufacturers; (vi) our ability to successfully enter into optimal strategic relationships with our subsidiaries and operating companies that we may form in the future; (vii) our ability to hold or generate significant operating capital, including through partnering, asset sales, and operating cost reductions; (viii) actual or anticipated variations in our operating results; (ix) actual or anticipated fluctuations in competitors' or collaborators' operating results or changes in their respective growth rates; (x) our cash position; (xi) market conditions in our industry; (xii) our expectations regarding the size of the patient populations amenable to treatment with our product candidates; (xiii) the volatility of our stock price; (xiv) the ability, and the ability of our collaborators, to protect our intellectual property and other proprietary rights and technologies; (xv) outcomes of pending and future litigation; (xvi) the rate and degree of market acceptance of any products developed by us, our subsidiaries, collaborations, or joint ventures, or JVs, and competition from existing technologies and products or new technologies and products that may emerge; (xvii) our ability to retain and recruit key personnel; (xviii) expectations related to the use of proceeds from public offerings and other financing efforts; and (xix) estimates regarding expenses, future revenue, capital requirements, and needs for additional financing.

Forward-looking statements are based on our beliefs, assumptions, and expectations of our future performance, and 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 "Summary of Risk Factors" set forth below and 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, the other reports we have filed with the Securities and Exchange Commission, or SEC, and the documents that we have filed as exhibits to our filings with the 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.

Market and Industry Data

This Annual Report contains industry and market data that are based on general and industry publications, surveys and studies commissioned or conducted by third parties, some of which may not be publicly available, and our own internal estimates and research. Third-party publications, surveys and studies generally state that they have obtained information from sources believed to be reliable, but do not guarantee the accuracy and completeness of such information. These data involve a number of assumptions and limitations and contain projections and estimates of the future performance of the industries in which we operate that are subject to a high degree of uncertainty. We caution you not to give undue weight to such projections, assumptions and estimates.

Summary of Risk Factors

We are subject to a variety of risks and uncertainties, including risks that could have a material adverse effect on our business, financial condition, results of operations, and cash flows. The following summary of the principal factors that make an investment in our securities speculative or risky should not be relied upon as an exhaustive summary of the material risks facing us. You should read the following summary together with the more detailed description of the risks that we deem material described under "Risk Factors" in Item 1A of this Annual Report and the other information contained in this Annual Report before investing in our securities.

Risks Related to our Financial Position and Capital Needs

- We have a history of net losses, we may not achieve or maintain profitability, and we will need substantial additional capital in the future in order to fund our business.
- We may incur substantially more debt or take other actions that would intensify the risks discussed above.

Risks Related to the Discovery and Development of our Product Candidates

- Our business is dependent on our ability to advance our current and future product candidates through clinical trials, obtain marketing approval, and ultimately commercialize them.
- The market opportunities for our product candidates may be smaller than we estimate.
- The regulatory process of the United States Food and Drug Administration, or FDA, and comparable foreign authorities are lengthy, time-consuming, and inherently unpredictable, and we may be unable to obtain FDA approval of our product candidates. The denial or delay of any such approval would prevent or delay commercialization of our product candidates and adversely impact our potential to generate revenue, our business, and our results of operations.
- Clinical development involves a lengthy and expensive process with uncertain outcomes. We may incur additional costs and experience delays in developing and commercializing or be unable to develop or commercialize our current and future product candidates.
- As an organization, we have limited experience designing and implementing clinical trials and failure to adequately design a trial, conduct a trial in accordance with regulatory requirements, or enroll patients in clinical trials, could result in adverse effects, including but not limited to increased or unexpected costs and delayed timelines.
- Cell and gene therapies are novel, complex, and difficult to manufacture.
- Interim and preliminary results from our clinical trials that we announce or publish from time to time may change, which could result in material changes in the final data.
- We have chosen to prioritize certain of our product candidates and, as a result, may expend our limited resources on product candidates that do not yield a successful product, or fail to capitalize on opportunities that may be more profitable.

Risks Related to the Commercialization of Product Candidates and Other Legal Compliance Matters

- Even if a product candidate receives marketing approval, it may fail to achieve the degree of market acceptance necessary for commercial success.
- Delays in obtaining regulatory approval of manufacturing processes and facilities or disruptions in manufacturing processes may delay or disrupt our commercialization efforts.
- Even if we receive marketing approval of a product candidate, we will be subject to ongoing regulatory obligations and continued regulatory review, which may result in significant additional expense.
- As a company, we have never commercialized a product, we currently have no active sales force or commercial infrastructure and we may lack the necessary expertise, personnel and resources to successfully commercialize our product candidates.
- The successful commercialization of our product candidates will depend in part on the extent to which third-party payers provide coverage and adequate reimbursement levels.
- We are subject to certain United States and foreign anti-corruption, anti-money laundering, export control, sanctions and other trade laws and regulations.

- Failure to comply with current or future federal, state and foreign laws and regulations and industry standards relating to privacy and data protection laws could lead to governmental enforcement actions (which could include civil or criminal penalties), private litigation, and/or adverse publicity.

Risks Related to our Business Operations and Strategy

- We rely on third parties to develop and commercialize some of our product candidates.
- 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.
- We may be sued for product liability.
- Our insurance policies are expensive and protect only from some business risks, which leaves us exposed to significant uninsured liabilities.
- Competitors and potential competitors may develop products and technologies that make ours obsolete or garner greater market share than ours.
- 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 continue to commercialize our product candidates.
- If we experience a significant breach of data security or disruption in our information systems, our business could be adversely affected.
- The effects of the COVID-19 pandemic have disrupted, and will likely continue to disrupt, our business operations, which could have a material adverse effect on our results of operations, cash flows, and financial position.
- We may pursue strategic acquisitions and investments that could have an adverse impact on our business.

Risks Related to our Intellectual Property

- Our ability to compete may decline if we do not adequately protect our proprietary technologies or intellectual property rights.
- Litigation or other proceedings or third-party claims of intellectual property infringement, misappropriation or other violation could require us to spend significant time and money and could prevent us from commercializing our technologies or impact our stock price.

Risks Related to our Common Stock

- 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 stock price is volatile, and purchasers of our common stock could incur substantial losses.
- We do not anticipate paying cash dividends, and accordingly, shareholders will have to rely on any stock appreciation for return on their investment.
- As of February 15, 2023, Randal J. Kirk controlled approximately 38 percent of our common stock and may be able to control or significantly influence shareholder votes and other corporate actions.
- Sales of a substantial number of shares of our common stock in the public market could occur at any time. This could cause the market price of our common stock to drop significantly, even if our business is doing well.
- Our articles of incorporation authorize us to issue preferred stock with terms that are preferential to those of our common stock.
- 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.

PART I

Item 1. Business

Overview

We are a dedicated discovery and clinical-stage biopharmaceutical company advancing the next generation of gene and cell therapies with the overall goal of improving outcomes for patients with significant unmet medical needs. We are leveraging our proprietary technology platforms to develop product candidates designed to target urgent and intractable diseases in our core therapeutic areas of immuno-oncology, autoimmune disorders, and infectious diseases. We have developed an extensive pipeline of therapies across multiple indications within these core focus areas.

We believe that our array of technology platforms uniquely positions us among other biotechnology companies to advance precision medicine. Precision medicine is the practice of therapeutic product development that takes into account specific genetic variations within populations impacted by a disease to design targeted therapies to improve outcomes for a disease or patient population. Our proprietary and complementary technology platforms provide a strong foundation to realize the core promise of precision medicine by supporting our efforts to construct powerful gene programs to drive efficacy, deliver these programs through viral, non-viral, and microbe-based approaches to drive lower costs, and control gene expression to drive safety. Our therapeutic platforms, including UltraCAR-T, AdenoVerse immunotherapy, and ActoBiotics, are designed to allow us to precisely control the level and physiological location of gene expression and modify biological molecules to control the function and output of living cells to treat underlying disease conditions.

We are actively advancing our lead clinical programs, including: PRGN-3005, PRGN-3006, and PRGN-3007, which are built on our UltraCAR-T platform; PRGN-2009 and PRGN-2012, which are based on our AdenoVerse immunotherapy platform; and AG019, which is built on our ActoBiotics platform. We also have a robust pipeline of preclinical programs that we are pursuing in order to drive long-term value creation.

We have developed a proprietary electroporation device, UltraPorator, designed to further streamline and ensure the rapid and cost-effective manufacturing of UltraCAR-T therapies. UltraPorator has received FDA clearance for manufacturing UltraCAR-T cells in clinical trials, and we have been dosing patients with UltraCAR-T cells manufactured with UltraPorator in our clinical trials.

We exercise discipline in our portfolio management by systematically evaluating data from our preclinical programs in order to make rapid "go" and "no go" decisions. Through this process, we believe we can more effectively allocate resources to programs that we believe show the most promise and advance such programs to clinical trials.

To guide our decision-making and operations, we have adopted the following tenets, which form the core of our operating ideology:

- **Financial Discipline.** Responsibly allocate capital in an effort to ensure maximum value creation.
- **Active Portfolio Management.** Continuously evaluate our portfolio and strictly adhere to data-driven "go" and "no go" decisions to advance programs with the highest probability of success.
- **Rapid Execution.** Advance priority programs quickly to value inflection points.
- **Strategic Partnerships.** Seek strategic partnerships to maximize value generation.

PRECIGEN'S VISION FOR PATIENTS

Develop life-saving and cost-conscious therapies utilizing our cutting-edge platform technologies for patients with unmet need



Our Strategy

Our strategy is to use our discovery and clinical development infrastructure to continue advancement of our clinical programs with the goal of improving outcomes for patients with significant unmet medical needs. The key elements of our strategy include:

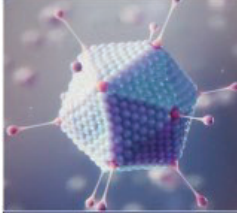
- **Advancing our lead clinical stage programs and seeking opportunities to maximize their value.** We are actively advancing our lead programs that we believe have significant potential value. We intend to efficiently pursue these programs toward clinical proof-of-concept and commercialization, whether independently or with collaborators.
- **Strategically pursuing our preclinical programs.** We have a robust pipeline of preclinical programs that we are pursuing in order to drive long-term value creation. We exercise discipline in our portfolio management by systematically evaluating data from our preclinical programs in order to make rapid "go" and "no go" decisions. Through this process, we believe we can more effectively allocate resources to programs that we believe show the most promise and advance such programs to clinical trials.
- **Leveraging our technology and therapeutic platforms across indications.** Through the application of our suite of proprietary and complementary synthetic biology technologies, we believe we can create optimized biological processes and overcome the limitations of traditional techniques, leading to precision medicines that are manufactured more efficiently and cost-effectively with superior performance. We continually assess the application of these technologies across therapeutic areas to determine where we can develop and provide unique solutions to challenges facing existing therapies.

We have strategically focused our efforts on developing an innovative pipeline of therapies based on our transformative UltraCAR-T, AdenoVerse immunotherapy, and ActoBiotics therapeutic platforms. A core focus of our research and development programs has been an effort to address the drawbacks associated with conventional cell and gene therapy manufacturing approaches. To this end, we are developing therapeutic candidates that reduce manufacturing risk by eliminating the need for centralized cell therapy manufacturing and have invested in internal manufacturing capabilities to de-risk our clinical production.



UltraCAR-T

- Non-viral multi-gene delivery
- Non-exhausted, stem-like T cell phenotype
- Higher antigen-specific expansion
- Enhanced *in vivo* persistence
- Ability to deplete with kill switch
- Overnight manufacturing process



AdenoVerse Immunotherapy

- Large payload capacity
- Low seroprevalence in humans
- Ability for repeat administration
- Durable antigen-specific immune response
- Highly productive manufacturing process

Our Clinical Pipeline

ADENOVERSE IMMUNOTHERAPY	PRODUCT	PLATFORM	INDICATION	DISCOVERY	PRECLINICAL	PHASE 1	PHASE 1B	PHASE 2	PHASE 3
	PRGN-2009	AdenoVerse	HPV* Solid Tumors	[Progress bar: Discovery to Phase 2]					
PRGN-2012	AdenoVerse	Recurrent Respiratory Papillomatosis (RRP)	[Progress bar: Discovery to Phase 2]						

ULTRACAR-T	PRODUCT	PLATFORM	INDICATION	DISCOVERY	PRECLINICAL	PHASE 1	PHASE 1B	PHASE 2	PHASE 3
	PRGN-3005	UltraCAR-T	Ovarian Cancer	[Progress bar: Discovery to Phase 1B]					
PRGN-3006	UltraCAR-T	AML, MDS	[Progress bar: Discovery to Phase 1B]						
PRGN-3007	UltraCAR-T	ROR1* Hematological & Solid Tumors	[Progress bar: Discovery to Phase 1]						

ACTOBIOTICS	PRODUCT	PLATFORM	INDICATION	DISCOVERY	PRECLINICAL	PHASE 1	PHASE 1B	PHASE 2	PHASE 3
	AG019	ActoBiotics	Type 1 Diabetes	[Progress bar: Discovery to Phase 2]					

Our Healthcare Business

Our healthcare business focuses on human therapeutics and developing research models and services for healthcare research applications. Our Biopharmaceuticals segment includes our wholly owned subsidiaries PGEN Therapeutics, Inc., or PGEN Therapeutics, and Precigen ActoBio, Inc., or ActoBio, as well as royalty interests in therapeutics and therapeutic platforms from companies not controlled by us. Exemplar Genetics, LLC, doing business as Precigen Exemplar, or Exemplar, is a wholly owned subsidiary which is focused on developing research models and services for healthcare research applications.

Biopharmaceuticals

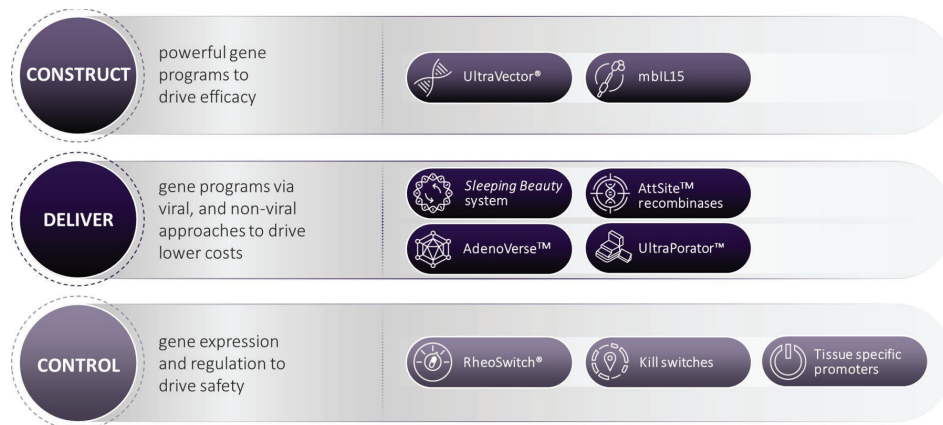
PGEN Therapeutics

PGEN Therapeutics is a dedicated discovery and clinical stage biopharmaceutical company advancing the next generation of gene and cell therapies using precision technology to target urgent and intractable diseases in immuno-oncology, autoimmune disorders and infectious diseases. PGEN Therapeutics operates as an innovation engine, progressing a preclinical and clinical pipeline of well-differentiated therapies toward clinical proof-of-concept and commercialization.

PGEN Therapeutics' Technology Platforms

We leverage a diverse portfolio of proprietary technology platforms to accelerate research and development efforts to deliver

the promise of precision medicine. Precigen's innovative technology platforms enable us to *construct* powerful, multigenic programs that we believe will drive efficacy, *deliver* multigenic constructs using viral and non-viral approaches that we believe will drive lower costs, and *control* expression of genes and performance of therapeutics *in vivo* for precise targeting of complex malignancies. The following discussion describes the technology platforms that we use for our approach to precision medicine.



We believe that the development of innovative biological products requires a deep understanding of the complexity of cellular processes and the construction of improved gene programs developed in conditions reflective of the natural environment. We accomplish the design of optimized gene programs for our therapeutic approaches via our UltraVector platform that incorporates advanced DNA construction technologies and computational models to design and assemble genetic components into complex gene expression programs. UltraVector-enabled matrices facilitate rapid identification of components that yield desired gene expression. Our library of characterized genetic components and associated functional characterization data enable construction of gene programs for optimized expression of multiple effector genes. Expression of our membrane-bound interleukin-15, or mbIL15, gene improves functional characteristics of certain immune cells, including T-cells, by enhancing their potential for expansion and persistence.

We deliver gene programs via viral, non-viral, and microbe-based approaches, including *Sleeping Beauty*, AttSite recombinases, and gorilla adenoviral vectors, from our AdenoVerse library. *Sleeping Beauty* is a non-viral transposon/transposase system licensed from the University of Texas MD Anderson Cancer Center that stably reprograms immune cells by inserting specific DNA sequences into their genome. The *Sleeping Beauty* system has been shown to promote random integration in the genome without insertion bias, which contrasts with the predilection of other viral and non-viral methods such as lentiviral vectors and the PiggyBac transposon system for integration at transcriptionally active sites. We believe that our non-viral system may confer benefits including a reduction of the risk of genotoxicity. Precigen has made significant improvements to the *Sleeping Beauty* system by optimizing gene elements, genetic payload capacity, and efficiency of delivery, which provides a system tailored to our multigenic UltraCAR-T platform. Our AttSite recombinases, which break and rejoin DNA at specific sequences in a unidirectional, irreversible fashion to direct integration of a transgene into the host cell genome, allow for stable, site-specific gene integration. The UltraPorator system includes proprietary hardware and software solutions and potentially represents major advancements over current electroporation devices by significantly reducing the processing time and contamination risk. UltraPorator is designed for rapid and cost-effective manufacturing of UltraCAR-T therapies and has the potential to enable rapid manufacturing of a range of gene and cell therapies beyond UltraCAR-T.

Genetically engineered adenoviruses (a common group of viruses) called adenovectors that are designed to insert genes into cells are an important part of our technology platforms. Our AdenoVerse technology platform is composed of a library of engineered adenovector serotypes that yield greater tissue specificity and target selection as compared to known human Ad5 adenovectors. This includes our gorilla adenovectors, which provide a potential competitive advantage with their large payload capacity, ability for repeat administrations and generation of robust antigen-specific immune responses.

The final component of our approach to precision medicine is our ability to control gene expression and regulation using the RheoSwitch, kill switches, and tissue-specific promoters. The RheoSwitch Therapeutic System, our inducible gene switch system, we believe is the most clinically advanced gene switch system and provides quantitative dose-proportionate regulation of the amount and timing of target protein expression in response to an orally available activator ligand, veledimex. In addition, we have developed a suite of kill switches, which allow us to selectively eliminate cell therapies *in vivo* after their administration, to improve their safety profile. We are developing tissue-specific promoters to only induce gene expression locally in cells or tissues of therapeutic interest.

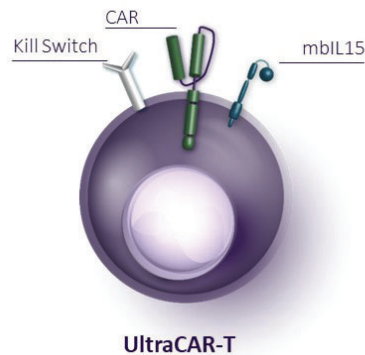
We have leveraged our proprietary and complementary technology platforms discussed above and our expertise in immunology to develop key therapeutic platforms, including UltraCAR-T and AdenoVerse, to address multiple pathways of complex disorders with significant unmet medical needs and to realize our core promise of precision medicine.

PGEN Therapeutics' Therapeutic Platforms

UltraCAR-T

Recent technological advances have revolutionized the field of immunotherapy for the treatment of cancer. Of the many immunotherapy approaches, chimeric antigen receptor T, or CAR-T, cell therapies in particular have shown remarkable responses in cancer patients with hematological malignancies. These therapies rely on the genetic modification of T-cells to express chimeric antigen receptors and enable these modified T-cells to bind to specific antigens on the patient's tumor cells and kill the tumor cells. Concerns remain, however, regarding complex and lengthy manufacturing processes and the safety profile of CAR-T cell therapies. Furthermore, current autologous and allogeneic CAR-T cell therapies face challenges in the treatment of solid tumors due to rapid exhaustion and limited *in vivo* persistence of CAR-T cells. Current approaches to CAR-T manufacturing require extensive *ex vivo* expansion following viral vector transduction to achieve clinically relevant cell numbers. We believe such an *ex vivo* expansion process can result in the exhaustion of CAR-T cells prior to their administration, limiting their potential for persistence in patients after administration. Furthermore, lengthy and complex manufacturing of current CAR-T approaches results in high manufacturing costs and long delays in providing the CAR-T treatment to cancer patients. Time is of the essence for advanced cancer patients and even modest delays in treatment can adversely affect outcomes.

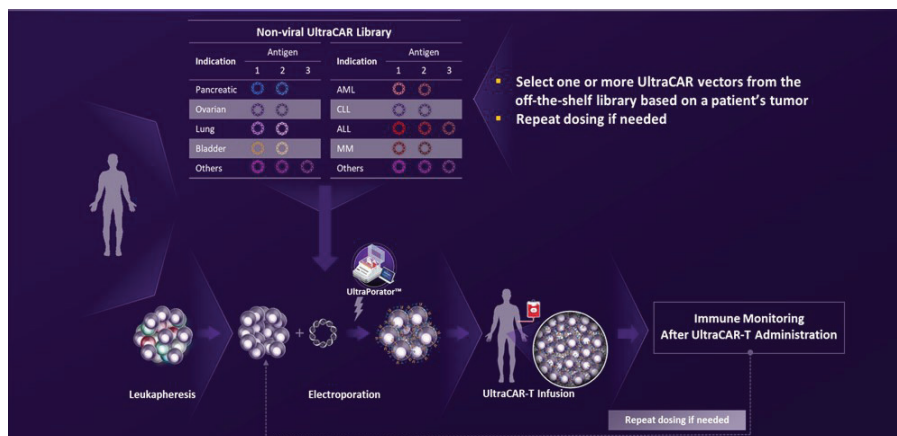
Our UltraCAR-T platform is differentiated from the competition, and we believe it has the potential to address the shortcomings of current technologies and disrupt the CAR-T treatment landscape by increasing patient access through shortening manufacturing time from weeks to days, decreasing manufacturing-related costs, and improving outcomes. We advanced the UltraCAR-T platform to address the inhibitory tumor microenvironment by incorporating intrinsic checkpoint blockade without the need for complex and expensive gene editing techniques. The next generation of UltraCAR-T utilizes a single multicistronic transposon DNA and the our overnight, decentralized manufacturing process of UltraCAR-T.



UltraCAR-T Differentiation

- Non-viral multi-gene delivery
- Uniform, multigenic cell product
- Stem-like T cell memory phenotype
- Higher antigen-specific expansion
- Enhanced *in vivo* persistence
- Ability to deplete with kill switch
- Overnight manufacturing process

We have introduced our vision for a new UltraCAR-T library approach, which is intended to transform the personalized cell therapy landscape for cancer patients. Our goal is to develop and validate a library of non-viral plasmids to target tumor-associated antigens. Enabled by what we believe to be design and manufacturing advantages of UltraCAR-T, coupled with the capabilities of the UltraPorator system, we are working to empower cancer centers to deliver personalized, autologous UltraCAR-T treatment with overnight manufacturing to any cancer patient. If our goal is realized, one or more non-viral plasmids could be selected based on the patient's cancer indication and biomarker profile from the library to build a personalized UltraCAR-T treatment. After initial treatment, this approach has the potential to allow for redosing of UltraCAR-T targeting the same or new tumor-associated antigens based on the treatment response and the changes in antigen expression of the patient's tumor.



The key advantages of UltraCAR-T versus the traditional CAR-T approaches include:

Advanced non-viral multigenic delivery system

We have optimized and advanced the *Sleeping Beauty* system using our UltraVector DNA construction platform to produce multigenic UltraCAR-T cells. As a result of this optimization, our UltraCAR-T cells are precision-engineered to produce a homogeneous cell product that simultaneously co-expresses antigen-specific CAR, kill switch, and mbIL15 genes in any genetically modified UltraCAR-T cell. We recently introduced the next generation UltraCAR-T platform that addresses the inhibitory tumor microenvironment by incorporating a novel mechanism for intrinsic downregulation of one or more checkpoint inhibitor, or CPI, genes. This design achieves intrinsic CPI blockade without gene editing and is aimed at avoiding systemic toxicity and the high cost of combining CPI antibodies. The next generation UltraCAR-T cells simultaneously express CAR, mbIL15, and a kill switch, and incorporates intrinsic CPI blockade using a single multicistronic non-viral transposon. This design differentiates our UltraCAR-T platform from the approaches used by our competitors and, we believe, reduces the developmental risk as compared to those approaches because product homogeneity is a critical consideration for later stages of clinical development and subsequent commercialization. We utilize our protein engineering and immunology expertise to optimize antigen binding, hinge, and signaling domains of each CAR based on the target antigen expression profile and cancer indication. We have also included our proprietary kill switch technology in our UltraCAR-T cells to improve the safety profile.

Enhanced persistence and elimination of ex vivo expansion step due to expression of mbIL15


A key driver of improved UltraCAR-T cell performance is mbIL15. The expression of mbIL15 has been shown to enhance *in vivo* expansion of UltraCAR-T cells in the presence of tumor antigens and prevent T-cell exhaustion to maintain a less differentiated, stem-cell like memory phenotype leading to longer persistence of UltraCAR-T cells. This yields an enduring anti-tumor response that has been shown to outlast conventional CAR-T cells in preclinical studies, which we believe is essential to successfully targeting solid tumors. This design allows us to eliminate the need for *ex vivo* expansion prior to administration, a requirement that is a major limitation of current CAR-T treatments.

Scalable, rapid, decentralized manufacturing process

Another key differentiator of the UltraCAR-T therapeutic platform is our rapid and decentralized proprietary manufacturing process, which allows us to manufacture UltraCAR-T cells overnight at a medical center's current good manufacturing practices, or cGMP, facility and reinfuse the patient the following day after gene transfer. This process improves upon current approaches to CAR-T manufacturing, which require extensive *ex vivo* expansion following viral vector transduction that we believe can result in the exhaustion of CAR-T cells prior to their administration, limiting their potential for persistence in patients. The decentralized nature of the manufacturing process allows us to scale beyond the confines of a dedicated facility. We believe we are the first company to validate non-viral, rapid, decentralized manufacturing of CAR-T cells in the clinic by infusing patients one day after gene transfer at two different sites in our ongoing clinical trials. We believe UltraCAR-T is the only autologous CAR-T platform with manufacturing, quality control release and infusion back to the patient, occurring in one day.

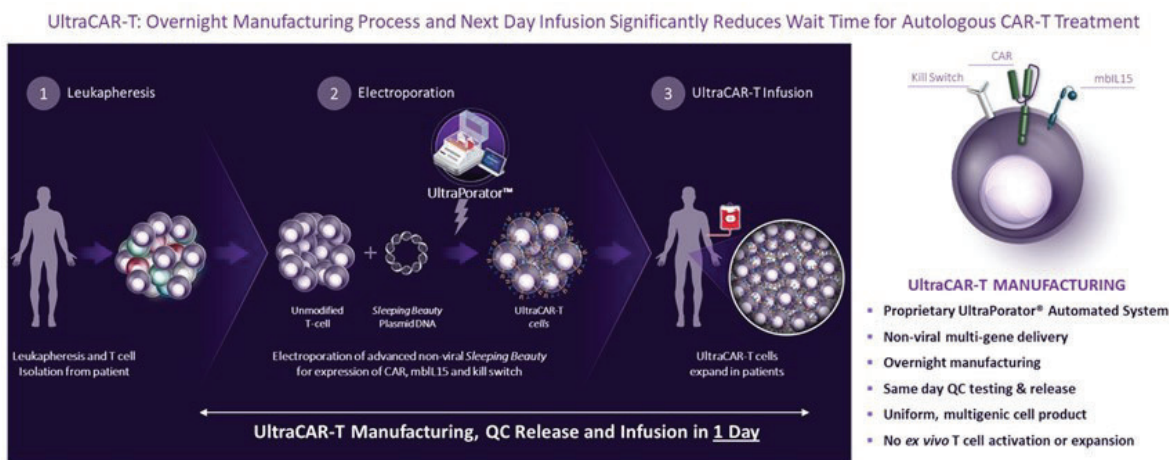
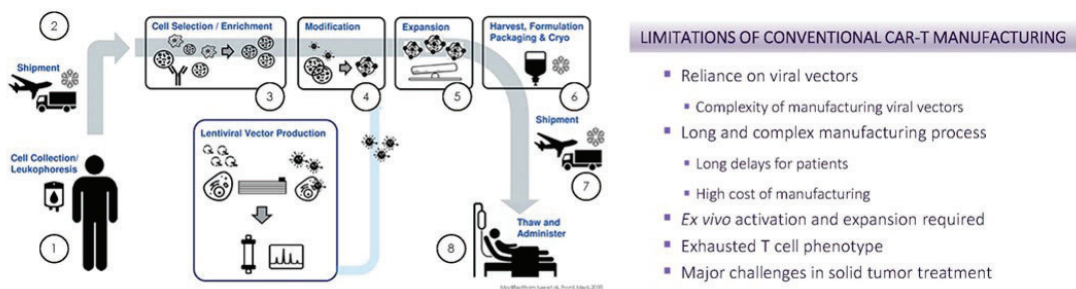
We have developed a proprietary electroporation device, UltraPorator, designed to further streamline and ensure the rapid and cost-effective manufacturing of UltraCAR-T therapies. The UltraPorator system, intended to be a viable scale-up and commercialization solution for decentralized UltraCAR-T manufacturing, includes proprietary hardware and software solutions and potentially represents major advancements over current electroporation devices by significantly reducing the processing time and contamination risk. The FDA has cleared UltraPorator as a manufacturing device for clinical trials of our UltraCAR-T

investigational therapies.



- Precigen's proprietary system
- Electroporation optimized for UltraCAR-T
- Semi-closed system minimizes manual handling and reduces processing time
- Rapid, high efficiency gene transfer protocol
- High throughput system handles a large number of T cells per batch
- Streamlines tech transfer & implementation at medical centers
- Potential application in various gene and cell therapies

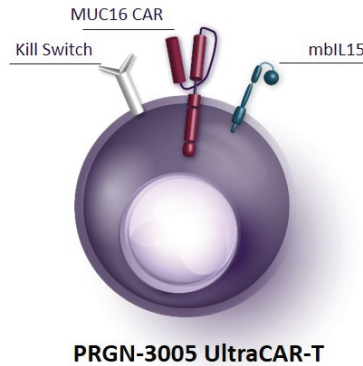
We believe our UltraCAR-T manufacturing process will provide a significant potential competitive advantage in the timeline and cost required to manufacture and deliver CAR-T therapies to patients as compared to current treatment approaches that require large, centralized facilities to support manufacturing of a relatively small number of treatments. We believe development of rapid and successful overnight manufacturing of UltraCAR-T therapies at medical centers signifies a paradigm shift in CAR-T therapy by eliminating manufacturing and timing risks associated with conventional CAR-T therapies, and our intent is for it to take place directly in numerous treatment centers, which can improve the accessibility of our therapies for patients.



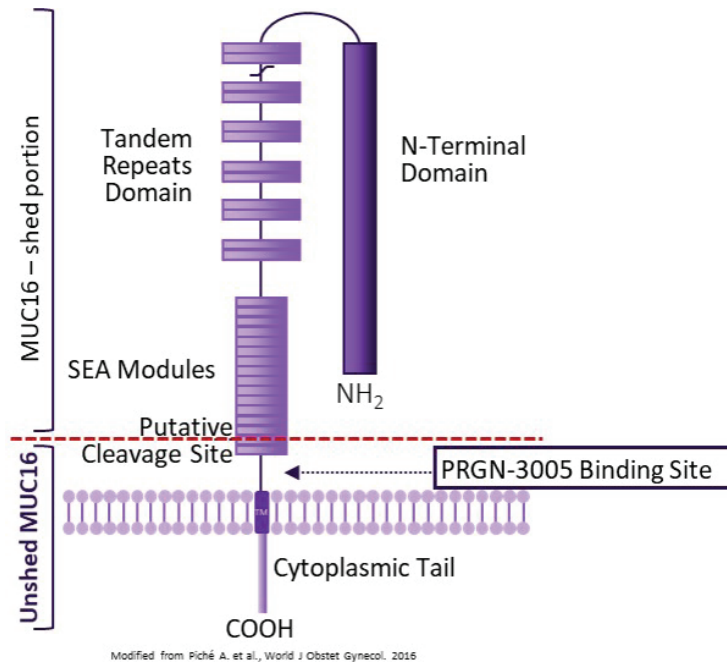
PGEN Therapeutics' most advanced programs based on the UltraCAR-T platform include PRGN-3005, which is in a Phase 1b clinical trial for patients with advanced ovarian, fallopian tube, or primary peritoneal cancer; PRGN-3006, which is in a Phase 1b clinical trial for patients with relapsed or refractory acute myeloid leukemia, or AML, and high-risk myelodysplastic syndromes, or MDS; and PRGN-3007, based on the next generation UltraCAR-T, which has received FDA clearance to initiate a Phase 1/1b clinical trial for patients with advanced receptor tyrosine kinase-like orphan receptor 1-positive, or ROR1⁺, hematological and solid tumors.

PRGN-3005

PRGN-3005 is a first-in-class, investigational autologous CAR-T therapy that utilizes our UltraCAR-T platform to simultaneously express a CAR targeting the unshed portion of the Mucin 16 antigen, or MUC16, mbIL15, and kill switch genes.



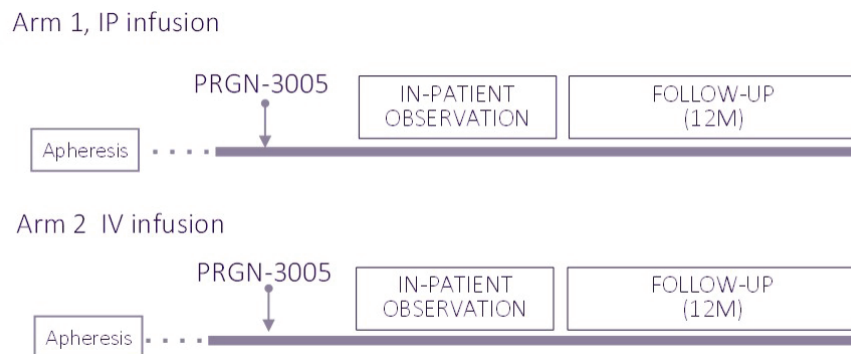
MUC16 is an extremely large, type I transmembrane cell surface glycoprotein that plays a key role in the pathogenesis of ovarian cancer by promoting an increase in cell proliferation, metastasis, resistance to chemotherapy and immune system evasion by cancer cells. MUC16 is overexpressed on more than 80 percent of ovarian tumors but has limited expression in healthy tissues, making it an attractive CAR-T target for ovarian cancer. Other cancers with known overexpression of MUC16 include pancreatic, breast, endometrial, lung, and bladder cancers. MUC16 undergoes proteolytic cleavage in the extracellular domain resulting in shedding of a large portion of extracellular domain, termed CA125, from the cell surface and leaving only a short, unshed extracellular domain tethered to the cell surface. Therapies that target the region of MUC16 that is shed from the cell surface may have limited effectiveness due to their binding to CA125 in circulation which is not associated with tumor cells. In order to eliminate binding to circulating CA125, we have designed our MUC16 CAR using an antigen binding domain that specifically binds the unshed portion of MUC16 and optimized its affinity to preferentially target PRGN-3005 to tumor cells.



PRGN-3005 is being evaluated for the treatment of advanced ovarian, fallopian tube, and primary peritoneal cancers. Advanced ovarian cancer is often fatal, with Stage IV survival rates as low as 20 percent, and has limited treatment options. Patients with ovarian cancer represent a large population, with approximately 300,000 patients diagnosed worldwide annually, including 22,000 in the United States alone.

In preclinical *in vitro* studies, PRGN-3005 UltraCAR-T cells have shown robust MUC16-specific cytotoxicity of ovarian cancer cell lines, a stem-cell like memory phenotype and significant improvement in their longevity even in the absence of exogenous cytokines as compared to conventional CAR-T cells. PRGN-3005 UltraCAR-T cells have shown significantly superior anti-tumor response in mouse models of ovarian cancer compared to mice treated with a saline solution or conventional MUC16 CAR-T cells lacking mbIL15 expression. Specifically, a single administration of PRGN-3005 one day after non-viral gene transfer showed significantly superior expansion and preferred memory phenotype of UltraCAR-T *in vivo* and significantly superior efficacy compared to traditional CAR-T resulting in all PRGN-3005 treated mice becoming tumor-free. Furthermore, rechallenging these tumor-free mice three months later with ovarian tumors for a second time (to simulate tumor relapse) led to the elimination of tumor burden without additional PRGN-3005 UltraCAR-T treatment. These data demonstrated the potential of UltraCAR-T cells to persist long-term *in vivo*, prevent CAR-T cell exhaustion, and mount a durable anti-tumor response with the ability to continue to respond upon tumor rechallenge.

The Phase 1/1b clinical study of PRGN-3005 is designed to enroll in two phases, an initial dose escalation phase (Phase 1) followed by a dose expansion phase (Phase 1b). We have completed enrollment in the Phase 1 dose escalation portion of the PRGN-3005 Phase 1/1b study. The Phase 1 portion of the study is a dual-arm, non-randomized, open-label clinical trial in patients with advanced, recurrent platinum-resistant ovarian, fallopian tube or primary peritoneal cancer. Patients in the Phase 1 dose escalation trial receive either intraperitoneal, or IP (Arm 1), or intravenous, or IV (Arm 2), administration of PRGN-3005 without prior lymphodepletion. The primary objectives of the Phase 1 trial are to assess the safety and maximum tolerated dose, or MTD, of PRGN-3005. For both routes of administration, PRGN-3005 will follow a 3+3 dose escalation pattern. We expect to enroll up to 71 patients total in this study.



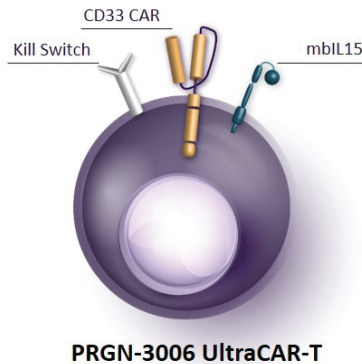
Interim data from the patients treated in the IP arm showed a favorable safety profile, dose-dependent expansion and persistence in the peripheral blood, and clinical activity as evidenced by a decrease or stabilization of total target tumor burden at the first restaging in a majority of patients. In addition, the UltraPorator system has enabled us to deliver higher UltraCAR-T doses than previous process with commercially available device, and we believe that our consistent ability to successfully manufacture UltraCAR-T cells at a medical center confirms the validity of our rapid, decentralized approach to manufacturing.

Previously we had announced FDA clearance to initiate dosing in the IV arm of the Phase 1 dose escalation trial concurrently with the IP arm and subsequent FDA clearance to start enrollment of patients in Dose Level 3 in the IV arm without the need to follow 3+3 dose escalation through Dose Levels 1 and 2. In January 2022, we announced the completion of enrollment in the dose escalation phase of both IP and IV arms without lymphodepletion in the ongoing Phase 1 clinical trial. We received FDA clearance to incorporate lymphodepletion at Dose Level 3 of the IV arm in the Phase 1 study and completed enrollment in the cohort. Follow up is ongoing for study patients and we expect to present Phase 1 data in the first half of 2023.

We have initiated the Phase 1b dose expansion study of PRGN-3005 UltraCAR-T at Dose Level 3 with lymphodepletion prior to IV infusion. We have received FDA clearance to incorporate repeat dosing in the Phase 1b expansion study and subsequently the first patient received repeat PRGN-3005 infusion. Site activation activities are in progress at multiple major cancer centers in the US for multicenter expansion of Phase 1b study.

PRGN-3006

PRGN-3006 is a first-in-class, investigational autologous CAR-T therapy that utilizes our UltraCAR-T platform to express a CAR to target CD33, mbIL15 and a kill switch for better precision and control.

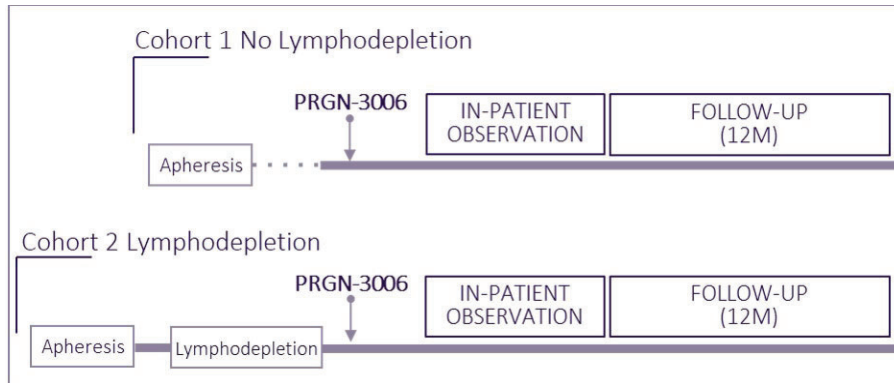


CD33, also known as Siglec-3, is a single pass transmembrane glycoprotein and a member of the sialic acid-binding immunoglobulin-like lectin super-family. CD33 is an attractive target for immunotherapy because it is over-expressed on AML blasts and leukemic stem cells, or LSCs, but is not expressed on normal blood stem cells, also known as hematopoietic stem cells. Approximately 85-90 percent of AML patients express CD33 on their tumor cells. In addition to broad expression on AML blasts, CD33 is expressed on LSCs underlying AML. LSCs are thought to be more resistant to chemotherapy treatment and to be capable of reinitiating the disease resulting in high relapse rates for AML. In healthy subjects, CD33 is primarily expressed on normal myeloid precursors, colony-forming cells, monocytes, and maturing granulocytes. Because CD33 is not expressed outside the hematopoietic system or on normal hematopoietic stem cells, it is an attractive target for treatment of AML.

AML is among the most common types of leukemia in adults with approximately 20,000 AML patients diagnosed in the United States annually. AML is a heterogeneous disease with 50-70 percent relapse rates and rapid progression. The prognosis for patients with AML is poor, with an average five-year survival rate of approximately 25 percent overall, and less than a 5 percent five-year survival rate for patients older than 65. More than 10,000 cases of higher-risk MDS are diagnosed annually in the United States. Due to the aggressive nature of AML progression, rapid availability of treatment is of even greater importance in this patient population, and our non-viral UltraCAR-T manufacturing process would represent a significant potential advantage over current approaches that require long lead times for manufacturing.

In preclinical studies, PRGN-3006 demonstrated robust expansion in the presence of CD33 antigen, lack of autonomous expansion in the absence of CD33 and prolonged persistence in the absence of exogenous cytokines. PRGN-3006 exhibited target-specific killing of CD33⁺ tumor cells as well as a significant release of inflammatory cytokines such as IFN γ , upon co-culture with AML tumor cells. PRGN-3006 cells were specifically eliminated by kill switch activator treatment, displaying functionality of the kill switch, which is intended to improve the safety profile of PRGN-3006. *In vivo*, a single administration of PRGN-3006 UltraCAR-T cells only one day after gene transfer effectively eliminated the tumor burden and significantly improved overall survival of tumor bearing mice compared to CAR-T cells lacking mbIL15 expression (conventional CAR-T) in an aggressive xenograft model of AML. PRGN-3006 demonstrated engraftment and significantly higher expansion and persistence in mice compared to conventional CAR-T cells, which lack mbIL15 expression.

The Phase 1/1b clinical study of PRGN-3006 is designed to enroll in two phases, an initial dose escalation phase (Phase 1) followed by a dose expansion phase (Phase 1b). We have completed Phase 1 dose escalation portion of the PRGN-3006 Phase 1/1b study. The Phase 1 portion of this study is a dual-arm, non-randomized, dose-escalation clinical trial where PRGN-3006 is delivered via intravenous infusion. The patient population includes relapsed or refractory AML, or r/r AML, higher-risk MDS, and CMML. In the 3+3 dose escalation phase, patients are treated in one of the two arms: patients in Cohort 1, or No Lymphodepletion arm, receive UltraCAR-T cell infusion without prior lymphodepletion, and patients in Cohort 2, or Lymphodepletion arm, receive lymphodepleting chemotherapy prior to UltraCAR-T infusion. The primary objective of this trial is to assess the safety of PRGN-3006 and determine the MTD.



In December 2022, the Principal Investigator of the PRGN-3006 clinical study presented complete Phase 1 data at the 64th American Society of Hematology Annual Meeting and Exposition. The presentation included the complete data set for the Phase 1 dose escalation portion of the study. The study enrolled a total of 26 patients (N=10 non-lymphodepletion; N=16 with lymphodepletion) and included 21 patients with r/r AML, 2 patients with chronic myelomonocytic leukemia (CMML), and 3 patients with MDS. The median age was 60.5 years (range: 32-77). Patients were heavily pre-treated with a median of 3.5 prior regimens (range: 1-9) and 58% of patients (N=15) had prior allogeneic hematopoietic stem cell transplantation (allo-HSCT). Patients treated in the non-lymphodepletion cohort and lymphodepletion cohort received a single administration of 1.8 to 50×10^6 and 4.4 to 83×10^6 UltraCAR-T cells via IV infusion, respectively.

In both the non-lymphodepletion (Cohort 1) and the lymphodepletion (Cohort 2) cohorts, PRGN-3006 was well-tolerated with no dose-limiting toxicities (DLTs) reported. The majority of treatment emergent adverse events (TEAEs) were either Grade 1 or 2. There was only one transient Grade 3 CRS reported in each cohort with the Cohort 2 event subsequently downgraded to Grade 1 by the investigator. Incidence of immune effector cell-associated neurotoxicity syndrome (ICANS) was rare with one Grade 1 event and one Grade 2 event in Cohort 1 and Cohort 2, respectively. No patients experienced a significant increase in serum IL-15, demonstrating that mbIL15 remains tethered to the UltraCAR-T cells as designed and is not released.

Excellent dose-dependent expansion and persistence of PRGN-3006 in peripheral blood and bone marrow was observed following a single infusion in both the non-lymphodepletion and lymphodepletion cohorts highlighting the ability of UltraCAR-T cells to engraft and survive even in the absence of lymphodepletion. Higher peak expansion (> 10 fold) in peripheral blood was observed in the lymphodepletion cohort compared to non-lymphodepletion cohort at the same dose level.

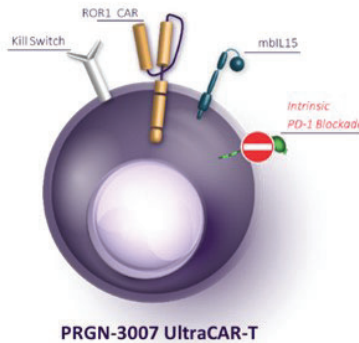
In the lymphodepletion cohort (Cohort 2), an objective response rate (ORR) of 27% (3 out of 11) was reported for heavily pre-treated r/r AML patients with poor prognosis (median prior treatments: 4; range: 1-9). Responders received a single PRGN-3006 dose ranging between 4.4 to 28×10^6 cells following lymphodepletion. A disease control rate (DCR) of 45% (5 out of 11) at day 28 for r/r AML patients and 100% of MDS patients, respectively. One patient with CRi was bridged to allo-HSCT at three months post treatment and remains in a measurable residual disease-negative CR 18 months post-transplant. Additionally, of the 15 evaluable patients in the lymphodepletion cohort (Cohort 2), 60% (9 out of 15) heavily pre-treated patients had a reduction in bone marrow blasts following a single PRGN-3006 infusion, with 4 patients experiencing a substantial decrease to $\leq 5\%$.

Analysis of peripheral blood samples post PRGN-3006 infusion showed gene expression changes consistent with improvement in the immune compartment function for anti-tumor effect in responders. There was an increase in cytotoxicity, costimulatory signaling, and lymphoid compartment and decreased apoptosis pathway scores in the lymphodepletion cohort on Days 14 and 28 post PRGN-3006 treatment compared to baseline.

We have initiated Phase 1b dose expansion study where PRGN-3006 is being evaluated following lymphodepletion. The Phase 1b dose expansion study of PRGN-3006 UltraCAR-T was expanded to Mayo Clinic in Rochester, Minnesota, joining the existing Moffitt Cancer Center, Tampa, Florida site enhancing the decentralized manufacturing model. The first patient was successfully dosed at the expansion site with PRGN-3006 UltraCAR-T. Site activation activities are in progress at several additional major cancer centers across the US as part of the multicenter expansion of the study. The Company received FDA clearance to incorporate repeat dosing in the Phase 1b expansion phase of the study, at the discretion of the treating physician. There is no requirement for additional lymphodepletion in repeat dose patients due to the demonstrated ability of PRGN-3006 to expand in the absence of lymphodepletion. PRGN-3006 has been granted Orphan Drug designation in patients with AML and Fast Track Designation in patients with r/r AML by the FDA.

PRGN-3007

PRGN-3007 is a first-in-class, investigational autologous CAR-T therapy that utilizes the next generation UltraCAR-T platform to express a CAR to target ROR1, mbIL15, kill switch, and a novel mechanism for the intrinsic blockade of the programmed death 1, or PD-1, gene expression.

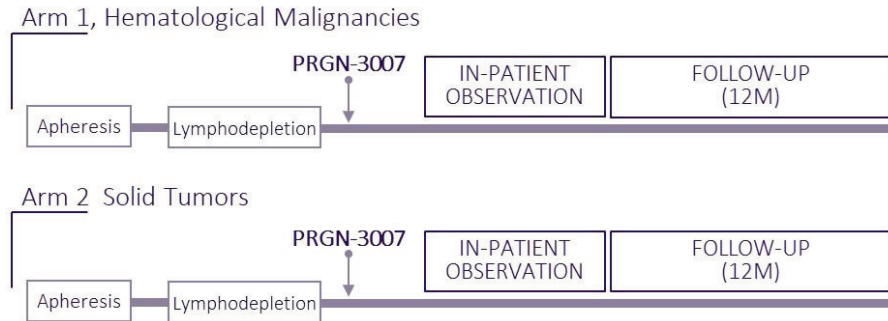


ROR1 is a type I orphan-receptor that is expressed during embryogenesis and by certain hematological and solid tumors but is undetectable on normal adult tissues. ROR1 in malignancies is aberrantly expressed in B-cell malignancies such as B-cell acute lymphoblastic leukemia, or B-ALL, diffuse large cell B-cell lymphoma, or DLBCL, chronic lymphocytic leukemia, or CLL, and mantle cell lymphoma, or MCL. Furthermore, upregulated expression has been detected in various solid tumors, including ovarian cancer, breast adenocarcinomas encompassing triple negative breast cancer, or TNBC, pancreatic cancer, Ewing's sarcoma and lung adenocarcinoma. The increased expression of ROR1 in hematological and solid tumor malignancies has been associated with tumor proliferation, metastasis and poor clinical outcomes.

The PD-1/programmed death ligand 1, or PD-L1, pathway plays a vital role in how tumor cells evade immune response. While the blockade of the PD-1/PD-L1 pathway has demonstrated considerable benefit for treating various cancers, the use of systemic CPI can lead to side effects associated with autoimmune response. The innovative design of PRGN-3007, where the blockade of PD-1 expression is intrinsic and localized to UltraCAR-T cells, is aimed at avoiding systemic toxicity and the high cost of CPI by eliminating the need for combination treatment.

In preclinical *in vitro* studies, PRGN-3007 showed significant reduction in PD-1 expression on UltraCAR-T cells compared to control ROR1 CAR-T cells lacking PD-1 blockade. The downregulation of PD-1 expression on PRGN-3007 resulted in enhanced ROR1-specific cytotoxicity and release of inflammatory cytokines upon co-culture with various ROR1-positive, or ROR1⁺, PD-L1⁺ hematological and solid tumor cells compared to Control ROR1 CAR-T, especially at low effector to target cell ratios. Single-cell cytokine proteomics showed that the downregulation of PD-1 expression on PRGN-3007 resulted in a significantly higher number of polyfunctional CAR-T cells compared to Control ROR1 CAR-T. Expression of mbIL15 on PRGN-3007 UltraCAR-T, with or without downregulation of PD-1 expression, resulted in robust expansion in presence of ROR1 antigen, lack of autonomous expansion in absence of ROR1, and durable persistence even in absence of exogenous cytokines *in vitro*. PRGN-3007 was selectively and effectively eliminated by the kill switch activator treatment demonstrating functionality of the kill switch, which is intended to improve the safety profile of PRGN-3007. In preclinical *in vivo* testing, a single administration of PRGN-3007, only one day after gene transfer, effectively reduced tumor burden and significantly improved overall survival of tumor bearing mice compared to Control ROR1 CAR-T in an aggressive xenograft model of mantle cell lymphoma. Blood analyses demonstrated sustained downregulation of PD-1 expression, rapid expansion, long-term persistence, and a predominant central memory phenotype of PRGN-3007 in tumor bearing mice.

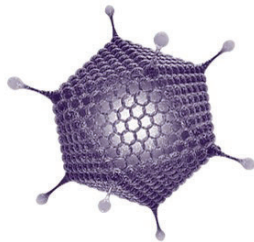
FDA has cleared the investigational new drug, or IND, application to initiate the Phase 1/1b clinical trial of PRGN-3007 in advanced ROR1⁺ hematological and solid tumors. The Phase 1/1b clinical trial is an open-label study designed to evaluate the safety and efficacy of PRGN-3007 in patients with advanced ROR1⁺ hematological (Arm 1) and solid (Arm 2) tumors. The target patient population for Arm 1 includes relapsed or refractory CLL, relapsed or refractory MCL, relapsed or refractory B-ALL, and relapsed or refractory DLBCL. The target patient population for Arm 2 includes locally advanced unresectable or metastatic histologically confirmed TNBC. The study will enroll in two parts: an initial 3+3 dose escalation in each arm followed by a dose expansion at the maximum tolerated dose. Arm 1 and Arm 2 will enroll in parallel. The Phase 1 trial will be conducted in collaboration with Moffitt Cancer Center, a pioneer in CAR-T clinical development. PRGN-3007 manufacturing technology transfer to Moffitt Cancer Center was completed for initiation of the Phase 1 study. The Phase 1 study is currently open for enrollment.



The lead investigator of the PRGN-3007 Phase 1 study presented an abstract titled, "A Phase1/1b Dose Escalation/Dose Expansion Study of PRGN-3007 UltraCAR-T Cells in Patients with Advanced Hematologic and Solid Tumor Malignancies," at the 64th American Society of Hematology Annual Meeting and Exposition.

"Off-the-shelf" AdenoVerse Immunotherapy

Our AdenoVerse immunotherapy platform utilizes a library of proprietary adenovectors for the efficient gene delivery of therapeutic effectors, immunomodulators, and vaccine antigens. We have established proprietary manufacturing cell lines and production methodologies from our AdenoVerse immunotherapy platform, which we believe are easily scalable for commercial supply. We believe that our proprietary gorilla adenovectors, part of the AdenoVerse technology, have superior performance characteristics as compared to current competition, including standard human adenovirus serotype 5, or Ad5, rare human adenovirus types and other non-human primate adenovirus types.



AdenoVerse Differentiation

- Large genetic payload capacity
- Off-the-shelf availability
- Ability for repeat administration
- Durable antigen-specific immune response
- Non-replicating adenoviruses
- Highly productive manufacturing process

The key advantages of AdenoVerse immunotherapy platform include:

Large genetic payload capacity

Our gorilla adenovectors have a larger genetic payload capacity than other viral vectors that currently dominate the gene therapy field, allowing us to engineer multigenic therapeutic candidates to treat complex diseases. Currently, we are able to engineer up to a 12kb genetic payload using our gorilla adenovectors, providing us with a significant advantage to express multiple genes in a controlled manner.

Repeat administration

Unlike most competing approaches, our gorilla adenovectors are suitable for repeat administration, which can lead to boosted antibody and T-cell responses. This suitability for repeat administration stems from the very low to non-existent seroprevalence of and limited immunity to gorilla adenoviruses in the human population. For example, our gorilla adenovector variant GC46 has been shown to have a seroprevalence of less than 6 percent in the United States, with low seropositive titers. In comparison, the seroprevalence of Ad5 in the United States is estimated to be 58 percent, with most of seropositive individuals having high titers. This high Ad5 seroprevalence limits the effectiveness of Ad5-based adenovectors in clinical studies. The rare and weak pre-existing immunity against gorilla adenovectors may therefore provide an advantage in clinical applications as compared to existing competition.

Replication incompetence

Our gorilla adenovectors are engineered and manufactured using a process that ensures the production of replication incompetent adenoviral therapeutic candidates with no cytopathic or cytotoxic effect in normal human cells. This has been achieved by engineering deletions of two regions essential for replication of the adenoviral genome. The use of a proprietary complementing cell line provides the necessary genetic elements for manufacture of AdenoVerse immunotherapy candidates. We believe our AdenoVerse immunotherapy candidates have reduced regulatory and commercialization risk due to their design, which renders them incapable of replicating and therefore less susceptible to manufacturing failures. Furthermore, our gorilla adenovector manufacturing process has yielded therapeutic candidates at a very high titer and has reduced the complexity of manufacturing.

Durable antigen-specific immune response

Gorilla adenovectors have been shown in preclinical studies to generate high-level and durable antigen-specific neutralizing antibodies and effector T-cell immune responses, as well as an ability to boost these antibody and T-cell responses via repeat administration.

cGMP Manufacturing Facility

One of our central differentiating factors and competitive gene therapy advantages is our investment in internal cGMP manufacturing capabilities in Germantown, Maryland, with the aim to reduce a myriad of risks that can impact manufacturing of viral vectors. These include technology transfer risks when outsourcing to contract manufacturing organizations as well as process and timing risks. Our modular cGMP facility with a small footprint was designed with agility and control in mind, focusing on rapid manufacturing and the ability to scale production appropriately to meet early-stage clinical trial needs of gene therapy vectors, especially our AdenoVerse-based therapeutics. We are able to generate greater than 1,000 doses of early phase clinical trial material at this facility at an expedited timeline and reduced cost compared to contract manufacturing organizations. As a result, we feel we are in a position to be in control of meeting our gene therapy manufacturing needs for our early-phase clinical trials.

PGEN Therapeutics' most advanced programs based on the AdenoVerse immunotherapy platform include: (i) PRGN-2009, a first-in-class, investigational "off-the-shelf" immunotherapy utilizing the AdenoVerse platform, is designed to activate the immune system to recognize and target human papillomavirus-positive, or HPV+, solid tumors, which is in a Phase 1/2 clinical trial for patients with HPV-associated cancers in collaboration with the National Cancer Institute, or NCI, pursuant to a cooperative research and development arrangement, or CRADA; and (ii) PRGN-2012, a first-in-class, investigational "off-the-shelf" AdenoVerse immunotherapy designed to elicit immune responses directed against cells infected with HPV type 6, or HPV6, or HPV type 11, or HPV11, which is in a Phase 2 trial in patients with recurrent respiratory papillomatosis, or RRP.

PRGN-2009

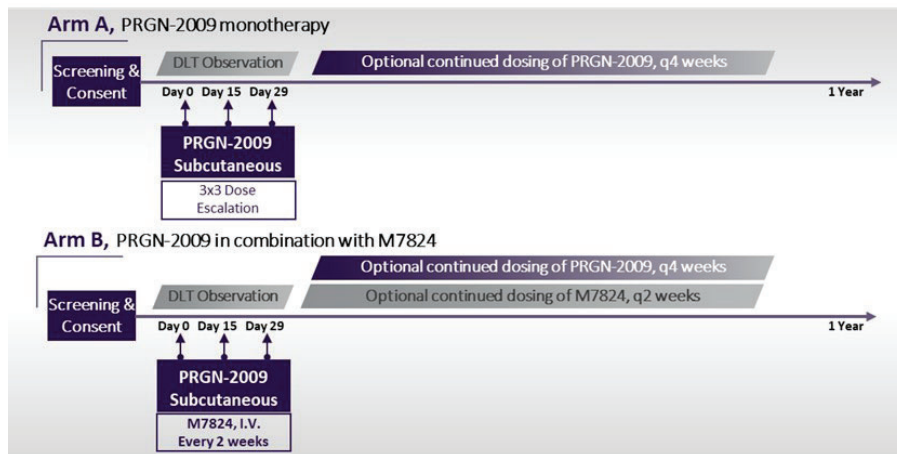
PRGN-2009, a first-in-class, "off-the-shelf" investigational immunotherapy, is designed to activate the immune system to recognize and target HPV+ solid tumors. PRGN-2009 leverages our UltraVector and AdenoVerse platforms to optimize HPV type 16, or HPV16, and HPV type 18, or HPV18, antigen design for delivery via a proprietary gorilla adenovector with a large genetic payload capacity and the ability for repeat administrations. Guided by our bioinformatics analysis and *in silico* protein engineering, PRGN-2009 encodes for a novel, multi-epitope antigen design to target HPV16 and HPV18 infected cells and potentially differentiates from the competition. PRGN-2009 has been engineered using our AdenoVerse platform to be replication deficient *in vivo*.

HPV infections account for 5 percent of all cancers globally, and 690,000 new cancer cases are attributable to HPV infections per year. HPV infects the squamous cell carcinoma. Some cervical cancers come from HPV infection of gland cells in the cervix and are referred to as adenocarcinomas. HPV-related cancers include cervical, oropharyngeal, anal, penile, vaginal, and vulvar. Nearly 44,000 HPV-associated cancers occur in the United States each year. Of these, approximately 25,000 occur in women and 19,000 occur in men. HPV is considered responsible for more than 90 percent of anal and cervical cancers, about 70 percent of vaginal and vulvar cancers, and more than 60 percent of penile cancers. Recent studies indicate that about 70 percent of cancers of the oropharynx also may be related to HPV.

In preclinical studies, PRGN-2009 treatment induced strong HPV-specific immune response and effectively controlled solid tumors in a murine model of HPV+ head and neck cancer. In a humanized mouse model of HPV+ cancer, PRGN-2009 treatment led to an increase in CD8 and CD4 T-cells in the tumor microenvironment and a reduction in the tumor. In a syngeneic mouse model of HPV+ cancer, repeated injections of PRGN-2009 monotherapy resulted in generation of high levels

of HPV-specific T-cells, and reduction in tumor burden. The combination of PRGN-2009 with bintrafusp alfa, or M7824, an investigational bifunctional fusion protein, further reduced tumor growth, increased HPV-specific T-cells, and increased T-cell infiltration into the tumor microenvironment *in vivo*.

PRGN-2009 is in a Phase 1/2 clinical trial for patients with HPV-associated cancers in collaboration with NCI pursuant to a CRADA. The Phase 1 portion of the study was designed to follow 3+3 dose escalation to evaluate the safety of PRGN-2009 administered as a monotherapy, Arm A, to determine the recommended Phase 2 dose, or R2PD, followed by an evaluation of the safety of the combination of PRGN-2009 at the R2PD and M7824, Arm B. The Phase 1 study population includes patients with recurrent or metastatic HPV-associated cancers. PRGN-2009 is administered via subcutaneous injection once every 2 weeks for three administrations and may be continued every 4 weeks for up to one year, as clinically appropriate. M7824 is administered on Day 1 and then every 2 weeks. The Phase 2 portion of the study is designed to evaluate PRGN-2009 as a monotherapy or combination therapy as a neoadjuvant or induction therapy in patients with newly-diagnosed stage II/III HPV16-positive oropharyngeal cancer and patients with newly diagnosed operable stage II/III/IVA/IVB HPV+ sinonasal squamous cell cancer.



In November 2021, the Principal Investigator of the PRGN-2009 clinical trial presented additional interim data at the Society for Immunotherapy of Cancer, or SITC, 2021 Annual Meeting.

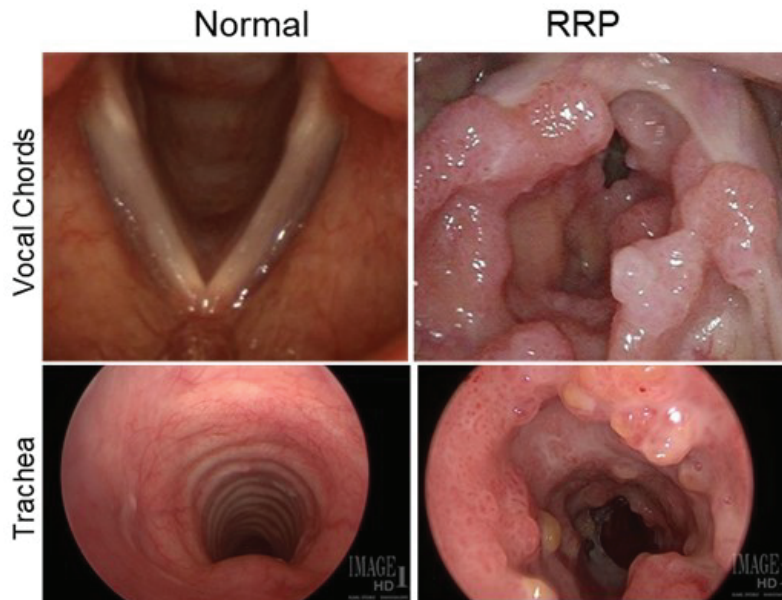
Phase 1 data showed a favorable safety profile of repeated PRGN-2009 administrations in both the monotherapy and the combination arms with no DLTs. In addition, there was not a significant neutralizing antibody response to gorilla adenovector post PRGN-2009 treatment, and there was not a significant increase in neutralizing antibody response over time with subsequent additional vaccinations in both the monotherapy and the combination arms. We believe that the lack of significant neutralizing antibody response highlights the ability to deliver repeated administrations of PRGN-2009, a major differentiation of our AdenoVerse immunotherapy platform. Phase 1 data showed encouraging clinical activity and patient case studies showed an increase in the HPV16 and/or HPV18-specific immune response after PRGN-2009 administration and an increase in the magnitude and breadth of immune response with respect to repeated administrations of PRGN-2009.

Enrollment in the Phase 1 monotherapy and combination therapy arms in patients with recurrent or metastatic HPV-associated cancers and patient follow up is ongoing. We expect to present monotherapy and combination therapy safety and efficacy data in the first half of 2023. In addition, enrollment in the monotherapy arm of the Phase 2 trial, which evaluates PRGN-2009 as a neoadjuvant therapy for newly diagnosed oropharyngeal or sinonasal squamous cell cancer (OPSCC) patients is ongoing with 19 of 20 estimated patients enrolled. Interim clinical data presentation from the Phase 2 monotherapy arm is expected in the second half of 2023. We plan to seek FDA guidance on a rapid regulatory strategy for PRGN-2009 given the positive interim results and significant unmet patient need.

PRGN-2012

PRGN-2012, a first-in-class, investigational "off-the-shelf" AdenoVerse immunotherapy for the treatment of RRP. PRGN-2012 is an innovative therapeutic vaccine with optimized antigen design that uses our gorilla adenovector technology, part of our proprietary AdenoVerse platform, to elicit immune responses directed against cells infected with HPV6 and HPV11. Gorilla adenovectors have numerous advantages, including the ability for repeat administration, the inability to replicate *in vivo*, which may improve safety, and the ability to deliver large payload capacity.

RRP is a rare, difficult-to-treat and sometimes fatal neoplastic disease of the upper and lower respiratory tracts that is caused by infection with HPV6 or HPV11. RRP is classified based on age of onset as juvenile or adult. RRP prevalence is estimated to be approximately 10,000 adult patients and 6,000 juvenile patients in the U.S and up to 60,000 adult patients outside the U.S., based on extrapolating U.S prevalence rates to populations in the EU, China and Japan. There is no approved therapeutic treatment for RRP and the current standard-of-care is repeated endoscopic debulking with ablation or excision of papillomatous lesions. Surgeries are not curative and recurrence of papilloma after surgical removal is very common and repeated procedures are required to debulk and monitor the disease, which exposes patients to anesthetic and surgical risks, and emotional distress. Patients with aggressive RRP can undergo hundreds of lifetime surgeries to control their disease. RRP morbidity and mortality results from the effects of papilloma mass on the vocal cords, trachea, and lungs, which may cause voice changes, stridor, airway occlusion, loss of lung volume, and/or post-obstructive pneumonia. Although rare, RRP has potential for malignant transformation in three to seven percent of adult patients. . In addition, more than 90 percent of genital warts are related to HPV6 and HPV11 infection.



In preclinical models, PRGN-2012 has demonstrated strong HPV6 and HPV11-specific T-cell response in RRP patient samples *in vitro*.

PRGN-2012 is currently under evaluation in a Phase 2 clinical trial. The clinical trial evaluates PRGN-2012 as an immunotherapy following standard-of-care surgery in adult patients with RRP. PRGN-2012 has been granted Orphan Drug Designation in patients with RRP by the FDA. PRGN-2012 is being developed in collaboration with the Center for Cancer Research at NCI through a CRADA.

We have completed Phase 1 dose escalation and dose expansion arms of the PRGN-2012 Phase 1/2 study. The Phase 1 clinical study evaluated safety and efficacy of PRGN-2012 as an immunotherapy following standard-of-care RRP surgery. Trial design included a 3+3 dose escalation cohort followed by a dose expansion cohort to enroll additional patients at the recommended Phase 2 dose (RP2D). Adult patients with severe, aggressive RRP, defined as greater than or equal to 3 surgeries in the prior 12 months, were eligible for the clinical trial.

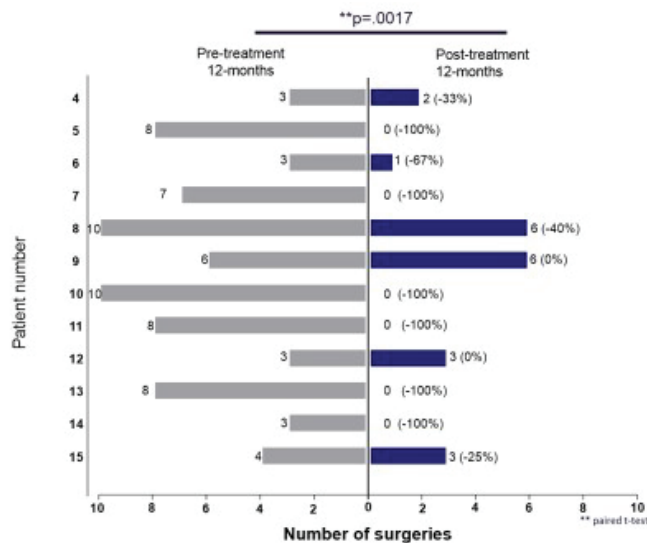
In January 2023, the lead associate investigator of the PRGN-2012 clinical study presented Phase 1 study data at our virtual R&D event. A total of 15 patients were enrolled in the Phase 1 study at one of the following dose levels with patients receiving four PRGN-2012 administrations (on days 1, 15, 43 and 85) via subcutaneous injection at one of the two dose levels: (i) Dose Level 1: 1×10^{11} viral particles (vp)/dose; N=3 ; or (ii) Dose Level 2: 5×10^{11} vp/dose; N=12. Baseline patient characteristics included a median age of 51 years (range: 30 to 73). Ten patients were male and five were female. Patients had an average of 6.2 surgeries (range: 3 to 10) in the prior 12-months before enrolling in the trial.



Phase 1 data demonstrated that the repeated administrations of PRGN-2012 were well-tolerated with no DLTs. There were no TRAEs greater than Grade 2. All patients received four administrations of PRGN-2012 at the intended dose level. TRAEs were all mild and reduced in frequency over the treatment interval. The most common TRAE was injection site reaction, which occurred in all of the patients. Most other TRAEs occurring in more than one subject were similar to seasonal vaccines and the most common were fatigue, fever, and chills. There was a low-level increase in neutralizing antibodies against gorilla adenovector after first administration and lack of significant neutralizing antibody response to gorilla adenovector over time with subsequent vaccinations highlights the ability to deliver repeated administrations of PRGN-2012.

Phase 1 efficacy data for Dose Level 1 showed that PRGN-2012 treatment reduced the need for surgeries for 100% (3 out of 3) severe, aggressive RRP patients. Patients in Dose Level 1 had a 33% (1 out of 3) Overall Response Rate (ORR), defined as greater than or equal to 50% reduction in the surgeries in 12-months post PRGN-2012 treatment completion compared to 12-months pre-treatment. Additionally, PRGN-2012 treatment at Dose Level 1 resulted in improvement in average time to recurrence (TTR), which is defined as time from start of treatment to first RRP surgery, post treatment.

Phase 1 efficacy data for Dose Level 2 showed PRGN-2012 treatment significantly reduced the need for surgeries for severe, aggressive RRP patients. At Dose Level 2, 50% (6 out of 12) patients had a Complete Response, which is defined as no surgeries needed during the 12-month period following PRGN-2012 treatment completion. As of January 12, 2023 data cutoff, all complete responders remained surgery-free post PRGN-2012 treatment. Patients in Dose Level 2 had a 58% (7 out of 12) ORR. 83% (10 out of 12) of patients treated at Dose Level 2 had reduced RRP surgeries in 12-months post PRGN-2012 treatment compared to pre-treatment. The number of RRP surgeries in the patients (N=12) in Dose Level 2 reduced from a median of 6.5 surgeries (range: 3-10) in the 12-months pre-treatment to 0.5 surgeries (range: 0-6) in 12-months post PRGN-2012 treatment completion. In addition, there was a significant improvement in TTR for patients treated with PRGN-2012 at dose level 2.



Additionally, PRGN-2012 treatment at Dose Level 2 showed significant improvement in anatomical Derkey scores, a tool used for research purposes to quantify RRP severity based on involvement of laryngeal structures, and voice quality, evaluated using the validated Vocal Handicap Index-10 (VHI-10), at 24-weeks post PRGN-2012 treatment completion compared to baseline.

The Phase 1 data showed that PRGN-2012 treatment resulted in an increase in HPV 6/11-specific T-cell response in the peripheral blood of RRP patients. Furthermore, the T-cells infiltrating papillomas from patients who had an objective response and a biopsy sample available showed an increase in HPV 6/11-specific T-cells in papillomas after PRGN-2012 treatment.

Enrollment is ongoing in Phase 2 study of PRGN-2012 with 20 patients enrolled to date. PRGN-2012 has been granted Orphan Drug designation for the treatment of RRP by the FDA.

Preclinical Programs

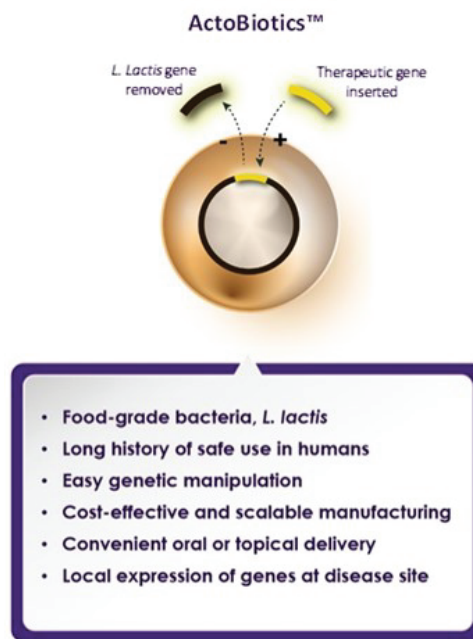
We have a robust pipeline of preclinical programs in order to drive long-term value creation. Our pipeline includes product candidates based on UltraCAR-T and "off-the-shelf" AdenoVerse immunotherapy therapeutic platforms. We expect to continue development of a number of potential product candidates in our preclinical pipeline and, consistent with our commitment to actively manage our portfolio programs, we exercise discipline in our portfolio management by systematically evaluating data from our preclinical programs in order to make rapid "go" and "no go" decisions. Through this process, we believe we can more effectively allocate resources to programs that we believe show the most promise and advance such programs to clinical trials. Precigen ActoBio

ActoBio is pioneering a proprietary class of microbe-based biopharmaceuticals that enable expression and local delivery of disease-modifying therapeutics. We refer to these microbe-based biopharmaceuticals as ActoBiotics.

Precigen ActoBio's Therapeutic Platforms

ActoBiotics

Our ActoBiotics platform is a unique delivery platform precisely tailored for specific disease modification with the potential for superior efficacy and safety. ActoBiotics combine the advantages of highly selective protein-based therapeutic agents with local delivery by the well-characterized and food-grade bacterium *Lactococcus lactis*, or *L. lactis*. ActoBiotics can be delivered orally in a capsule, through an oral rinse or in a topical solution. We believe ActoBiotics have the potential to provide superior safety and efficacy via the sustained release of appropriate quantities of select therapeutic agents as compared to injectable biologics, while reducing the side effects commonly attributed to systemic delivery and corresponding peaks in concentration. ActoBiotics work via genetically modified bacteria that deliver proteins and peptides at mucosal sites, rather than the insertion of one or more genes into a human cell by means of a virus or other delivery mechanism. By foregoing this insertion, ActoBiotics allow "gene therapy" without the need for cell transformation.



The key advantages of ActoBiotics include:

Food-grade bacterium with easy genetic manipulation

ActoBiotics combine the advantages of highly selective protein-based therapeutic agents with local delivery by the well-characterized and food-grade bacterium with *L. lactis*, which has a long history of safe use. ActoBiotics are generated by genetically modifying *L. lactis* via chromosomal integration through targeted double homologous recombination to express and release a variety of highly versatile biological moieties. Multiple therapeutic agents, such as proteins, peptides, and antibodies, can be incorporated into a single ActoBiotics therapeutic, enabling the simultaneous targeting of multiple pathways in one disease. The *L. lactis* host is also engineered for environmental containment, thus preventing the spread of bacteria outside the human body.

Cost-effective and scalable manufacturing

We have established an efficient and reliable cGMP manufacturing process for the production of ActoBiotics that we believe is easily scalable for commercial supply. The manufacturing process involves fermentation of genetically modified *L. lactis* to generate significant quantities of the therapeutic agent, followed by concentration and freeze-drying. The process does not require the costly purification required to produce conventional biologics.

Convenient delivery method

ActoBiotics can be delivered to the oral cavity through a mouthwash, intestinally via a capsule, or through a topical formula. Physiological dosing is low, and our ActoBiotics product candidates have been well-tolerated in preclinical and clinical studies. As compared to conventional biologics, we believe ActoBiotics have the potential to provide superior safety and efficacy via the sustained release of appropriate quantities of select therapeutic agents while reducing the side-effects commonly attributed to systemic delivery and corresponding peaks in concentration of conventional biologics.



ActoBio's most advanced internal pipeline candidate, AG019, is a first-in-class disease modifying antigen-specific, investigational immunotherapy for the prevention, delay, or reversal of type 1 diabetes mellitus, or T1D. AG019 is an easy-to-take capsule formulation of ActoBiotics engineered to deliver the autoantigen human proinsulin, or hPINS, and the tolerance-enhancing cytokine human interleukin-10 to the mucosal lining of gastro-intestinal tissues in patients with T1D. We believe this design can reduce T1D pathology by reestablishing immunological tolerance to islet antigens via the production of regulatory T, or Treg, cells.

T1D represents a highly unmet medical need, with approximately 132,000 patients, most commonly children and young adults, diagnosed each year. In T1D, the immune system destroys insulin-producing beta cells in the pancreas, creating a blood glucose imbalance and numerous symptoms, including polyuria, polydipsia, polyphagia, weight loss, lassitude, nausea and blurred vision. The current treatment standard for T1D consists of exogenous insulin along with diet and lifestyle modification, but no disease-modifying treatment is available. We believe that AG019 has the potential to address the unmet medical need for disease modifying treatment in T1D.

Preclinical studies in mice have shown that AG019, in association with a short-term treatment with a low-dose anti-CD3 monoclonal antibody, induced stable reversion to normal blood sugar levels and reversed the disease in diabetic mice treated at an early stage. Furthermore, AG019 treatment induced accumulation and proliferation of PINS-specific FoxP3⁺ Treg cells in the pancreas and peripheral lymph nodes.

We have completed a Phase 1b/2a clinical trial of AG019 for the treatment of early-onset T1D. The Phase 1b open-label portion

of the study evaluated the safety and tolerability of AG019 monotherapy administered as a single dose and repeated daily doses in adult and adolescent patients. The Phase 2a double-blind portion of the study investigated the safety and tolerability of AG019 in combination with teplizumab, or PRV-031.

One of the lead investigators of the AG019 clinical trial presented results from the primary analysis at the Federation of Clinical Immunology Societies (FOCIS) 2021 Virtual Annual Meeting. In addition, one of the lead investigators of the AG019 clinical trial presented additional interim data at the European Association for the Study of Diabetes (EASD) 57th Annual Meeting in October 2021.

The primary endpoint of both the Phase 1b AG019 monotherapy and the Phase 2a AG019 combination therapy was met. AG019 was well-tolerated when administered to adults and adolescents either as monotherapy or in combination with teplizumab. A single 8-week treatment cycle of oral AG019 as a monotherapy and in combination with teplizumab showed stabilization or increase of C-peptide levels during the first 6 months post treatment initiation in recent-onset T1D. In an independent analysis performed in a subset of adult and adolescent patients by the Immune Tolerance Network (ITN), a leading independent research group sponsored by the United States National Institutes of Health, AG019 monotherapy and combination therapy induced antigen-specific tolerance in conjunction with the reduction of disease-specific T-cell responses. The extent of these antigen-specific immune modulatory effects in the combination therapy patients was similar to what was seen in AG019 monotherapy patients indicating that this effect may be attributed to the single 8-week treatment cycle of oral AG019.

Partnered Program

We previously entered into a collaboration with Castle Creek Biosciences, Inc., or Castle Creek, to advance certain product candidates. Pursuant to the collaboration, we licensed our technology platforms to Castle Creek for use in certain specified fields, and in exchange, we received and were entitled to certain access fees, milestone payments, royalties, and sublicensing fees related to the development and commercialization of product candidates. In March 2020, we and Castle Creek terminated the original collaboration agreement by mutual agreement, with the parties agreeing that certain product candidates would be treated as "Retained Products" under the terms of the original agreement. Castle Creek retains a license to continue to develop and commercialize the Retained Products within the field of use for so long as Castle Creek continues to pursue such development and commercialization, and we are also entitled to certain royalties with respect to the Retained Products. One such Retained Product is D-Fi (debcodemagene autoficel), formerly designated FCX-007, for the treatment of recessive dystrophic epidermolysis bullosa, or RDEB.

Precigen Exemplar

Exemplar is committed to enabling the study of life-threatening human diseases through the development of MiniSwine Yucatan miniature pig research models and services, as well as enabling the production of cells and organs in its genetically engineered swine for regenerative medicine applications. Historically, researchers have lacked animal models that faithfully represent human diseases. As a result, a sizeable barrier has blocked progress in the discovery of human disease mechanisms; novel diagnostics, procedures, devices, prevention strategies and therapeutics; and the ability to predict in humans the efficacy of those next-generation procedures, devices, and therapeutics. Exemplar's MiniSwine models are genetically engineered to exhibit a wide variety of human disease states, which provides a more accurate platform to test the efficacy of new medications and devices.

As of December 31, 2022, Exemplar had 33 employees. Exemplar's primary domestic production facilities, are located in Flandreau, South Dakota, and Johnson County, Iowa, and include approximately 107,000 square feet of production, lab, and office facilities.

Competition: Healthcare Business

While we believe that our novel approach to developing the next generation of gene and cell therapies utilizing our UltraCAR-T. AdenoVerse immunotherapy or ActoBiotics platform to target the most urgent and intractable challenges in immunoncology, autoimmune disorders, and infectious diseases provides us with competitive advantages, our industry is highly competitive and subject to rapid and significant technological change. Many of our competitors have significantly greater financial, technical, and human resource capabilities than we do, and certain of our competitors may also benefit from local government subsidies and other incentives that are not available to us. In addition, mergers and acquisitions in the pharmaceutical and biotechnology industries may result in even more resources being concentrated among a smaller number of our competitors. As a result of the resources available to our competitors, 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 can.

Product candidates that we successfully develop and commercialize will compete with a range of therapies that are currently approved and any new therapies that may become available in the future. Our ability to compete successfully will depend on our ability to develop proprietary technologies that can be used 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. The availability of reimbursement from government and other third-party payers will also significantly affect the pricing and competitiveness of our products. Our competitors may also obtain FDA or other regulatory approval for their products more rapidly than we may obtain approval for ours, which could result in our competitors establishing a strong market position before we are able to enter the market. Key product features that would affect our ability to effectively compete with other therapeutics include the efficacy, safety and convenience of our products, as well as the availability of intellectual property protection.

UltraCAR-T

Our lead product candidates include PRGN-3005, PRGN-3006, and PRGN-3007, each of which are built on our UltraCAR-T platform, and PRGN-2009, which is based on our AdenoVerse immunotherapy platform. While we are employing a novel approach, there are a number of competitors pursuing CAR-T cell therapies for the treatment of cancer. We believe that, among others, Bristol-Myers Squibb, Tmunity Therapeutics, and Anixa Biosciences are developing CAR-T based treatments for ovarian cancer and TCR2 Therapeutics is developing TCR-T based treatment for ovarian cancer. We believe that Celyad, Mustang Bio, Kite, Amgen, Collectis S.A., and Allogene Therapeutics are also using CAR-T technology to develop product candidates for the treatment of AML. We believe that Bristol-Myers Squibb, Lyell Immunopharma, and Oncternal Therapeutics are developing ROR1 CAR-T cells for treatment of ROR1-positive cancers. We believe that INOVIO Pharmaceuticals, AstraZeneca, Transgene SA, PDS Biotech, and Advaxis Immunotherapies are developing immunotherapies against HPV-associated cancers.

Bristol-Myers Squibb's product candidate, JCAR020, is a MUC16-IL-12 armored T-cell therapy being developed to treat ovarian cancer. Similar to our UltraCAR-T platform, this product candidate targets MUC16 on ovarian tumors. JCAR020 is engineered with "armored CAR" technology to co-express CAR and IL-12, a cytokine that can help overcome the inhibitory effects that the tumor micro-environment can have on T-cell activity. Tmunity Therapeutics is developing Tm Tn-MUC 01 CAR-T for various solid tumors including ovarian cancer. This candidate targets TnMUC-1 antigen on tumor cells. Tmunity Therapeutics is also developing TmMSLN-01 CAR-T targeting mesothelin for various solid tumors including ovarian cancer. TCR2 Therapeutics' gavocabtagene autoleucel (gavo-cel, formerly TC-210) targets mesothelin and is based on TCR Fusion Construct T-cells, or TRuC-T cells, technology and is manufactured using lentiviral transduction of autologous T-cells. TCR2 is also developing TC-510 targeting mesothelin for various solid tumors including ovarian cancer. Anixa Biosciences is developing an autologous CAR-T treatment targeting follicle stimulating hormone receptor (FSHR) for ovarian cancer, which we believe is in a clinical trial. Arsenal Biosciences is developing AB-1015 CAR-T, which we believe is in a clinical trial for platinum resistant ovarian cancer. Regeneron and 2seventy bio are developing bbT4015, an engineered CAR T-cell therapy targeting MUC16, which we believe is in preclinical development.

For the treatment of AML using cell therapies, we believe that Mustang Bio, Kite, 2seventy bio and Nkarta have product candidates in the most advanced clinical trials. Mustang Bio's product candidate, MB-102, is an investigational autologous CAR-T cell therapy that is produced by engineering patient T-cells to recognize and eliminate CD123-expressing tumors. Kite is developing KITE-222, an investigational autologous T-cell therapy engineered with a CAR that specifically targets CLL-1 for treatment of AML. We believe that 2seventy bio is developing DARIC33, a pharmacologically controlled CD33-targeted CAR-T therapy which is in a clinical trial for pediatric AML. Nkarta is developing NKX101, an investigational allogeneic NK cell therapy expressing a CAR target NKG2D ligands and mbIL-15. We believe NKX101 is in a clinical trial for AML and MDS. Amgen is developing AMG 553, an FMS-like tyrosine kinase 3, or FLT3, CAR-T cell therapy utilizing autologous T-cells genetically modified *ex vivo* to express a transmembrane CAR to target FLT3 protein on the surface of AML cells irrespective of FLT3 mutational status. Collectis S.A. is also developing UCART123, an allogeneic anti-CD123 CAR-T cell therapy, which utilizes lentivector transduction followed by TALEN-mediated gene editing to eliminate expression of TCR $\alpha\beta$ from donor T-cells. Vor Biopharma is developing VOR33, an investigational hematopoietic stem cell (HSC) therapy with elimination of CD33 expression via gene-editing, in combination with MylotargTM, an anti-CD33 antibody drug conjugate (ADC). Vor Biopharma is also developing VCAR33, an autologous anti-CD33 CAR-T as a monotherapy and in combination with VOR33. We believe Gracell is developing GC017 for AML, which is in preclinical development. Finally, Allogene Therapeutics' allogeneic CAR-T therapies ALLO-316 and ALLO-819, targeting FLT3 and CD70, respectively, which we believe are in preclinical development for AML, are manufactured using healthy donor T-cells that are engineered using lentiviral transduction to express CAR followed by gene editing to eliminate expression of TCR to reduce the potential of rejection of therapy by a patient's immune system.

Bristol-Myers Squibb Lyell Immunopharma is developing LYL797, a ROR1-targeted CAR T-cell product, which we believe recently received FDA clearance to initiate Phase 1 clinical trial for patients with relapsed/refractory ROR1+TNBC or non-

small cell lung cancer, or NSCLC. We believe that Lyell is also developing another ROR1 CAR-T candidate, LYL119, which is in preclinical development for ROR1+ solid tumors. Oncternal Therapeutics is developing ONCT-808, a ROR1 targeted autologous CAR-T cell therapy, which we believe is currently in preclinical development, initially as a potential treatment for hematologic malignancies.

In addition to our direct competitors that are using CAR-T therapies specifically for the treatment of ovarian cancer and AML, the CAR-T technology space has significant other competition including from multiple companies and their collaborators, such as Novartis and University of Pennsylvania, Kite and Gilead, Bristol-Myers Squibb, Legend Biotech, Adaptimmune and GSK, Autolus Therapeutics, 2seventy bio, Poseida Therapeutics, Gracell and Bellicum Pharmaceuticals. We also face competition from non-cell based cancer treatments offered by other companies such as Amgen, AstraZeneca, Incyte, Merck, Abbvie, and Roche.

See "PGEN Therapeutics' Therapeutic Platforms" for a discussion of the features that we believe differentiate our UltraCAR-T treatments from our competitors.

AdenoVerse Immunotherapy

For our PRGN-2009 candidate in HPV-associated cancers, we believe that INOVIO Pharmaceuticals, AstraZeneca, BioNTech SE, PDS Biotechnology, and Transgene S.A. are developing immunotherapies that are in clinical testing. TG4001 is an investigational therapeutic cancer vaccine candidate using an attenuated and modified poxvirus, or MVA, as a vector expressing the HPV16 E6 and E7 proteins and interleukin-2. We believe TG4001 is in a clinical trial in combination with anti-PD-L1 antibody avelumab for anogenital HPV+ cancers. INOVIO's lead investigational candidate VGX-3100 is a plasmid DNA based vaccine designed to increase T cell immune responses against the E6 and E7 antigens of HPV16 and HPV18. VGX-3100 is in clinical trials for precancerous cervical dysplasia, vulvar dysplasia, and anal dysplasia. We believe BioNTech is developing BNT113, an investigational HPV16 E6/7 mRNA vaccine. We believe BNT113 is in a clinical trial for HPV16+ Head and Neck cancer. We believe PDS Biotechnology is developing PDS-0101, an investigational HPV16 peptide vaccine for various HPV-associated cancers. We believe PDS0101 is in clinical trials as monotherapy for recurrent/metastatic HPV16+ head and neck cancer, pre-metastatic HPV-associated oropharyngeal cancer, and locally advanced (IB3-IVA) cervical cancer as well as combination therapy for HPV+ anal, cervical, head and neck, penile, vaginal, vulvar cancers. Cellid is developing BVAC-C, which is based on CeliVax technology that uses patient-derived B cells and monocytes transfected with E6/E7 recombination gene of HPV16 and HPV18 and loaded with an adjuvant for HPV-associated cancers.

In addition to our direct competitors developing vaccines for treatment of HPV-associated cancers, various development-stage companies are involved in different vaccine and immunotherapy technologies, including Advaxis Immunotherapies, Bavarian Nordic, and Altimune. We also face competition from non-vaccine based approaches being developed by companies such as Kite, Iovance, Bristol-Myers Squibb, and Merck.

For our product candidate PRGN-2012 for the treatment of RRP, while we believe our approach for PRGN-2012 is novel based on the design of antigen targeting HPV6 and HPV11 and use of our gorilla adenovector, we face competition in the treatment of RRP. We believe our main competitor in the field is INOVIO Pharmaceuticals with their investigational DNA vaccine INO-3107 targeting HPV6 and HPV11 antigens.

Actobiotics

We are also using our suite of proprietary and complementary synthetic biology technologies for the preclinical and clinical development of product candidates for the treatment of autoimmune disorders, including T1D. While we believe AG019 is the first disease-modifying treatment for T1D, there are a number of competitors pursuing immunotherapy product candidates to treat T1D. We believe that our primary competitors with respect to the development of immunotherapies for T1D are Provention Bio, Midatech Pharma, and MerciaPharma.

Exemplar

Precigen Exemplar is providing porcine research models and services that aid scientists in the understanding of human disease mechanisms and development of new therapeutics. We use precise genome modification to recapitulate numerous human diseases in our Yucatan MiniSwine platform, which are utilized by our industry and academic clientele for the development of new small molecule, gene, and cell therapies. Competition in this space includes Surrogen and Renovate.

Intellectual Property

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. As we advance technologies, we evaluate and determine under the circumstances what type or types of intellectual property is appropriate for the technology, including patents, trademarks, know-how and trade secret protections. We seek patent protection in the United States and in other countries for our inventions, and we develop and protect our know-how and trade secrets relating to our platform technologies, as well as to our pipeline products including those of our subsidiaries and collaborators.

For instance, we pursue protection to switch technologies, gene delivery technologies, and genetic componentry related to our pipeline products. In addition, we seek patents covering specific collaborator's products.

We focus our intellectual property on aspects of our platforms and technologies that provide for the design and creation of cells, vectors and components for our pipeline and the pipelines of our collaborators, as well as technologies directed to improve delivery and expression of our pipeline products.

Our success depends, in part, upon our ability to obtain patents and maintain adequate protection for our intellectual property relating to our technologies and product pipeline. 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 technologies and product pipeline. For instance, where we believe appropriate, we have counterpart patents and patent applications in other jurisdictions, such as Australia, Canada, China, Europe, Hong Kong, India, Israel, Japan, Korea, and South Africa. In the future, we may file in these or additional jurisdictions as deemed appropriate for the protection of our technologies.

As of December 31, 2022, we owned or in-licensed patents in United States patents and have pending United States patent applications relating to various aspects of our platforms and 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 advancing technologies, methods and products as we and our collaborators deem appropriate.

We work to maintain protection for our key technologies including: our various switch technologies, with a last to expire patent currently in 2038; our portfolio around various gene delivery technologies and their use, with a last to expire patent in 2040; and our portfolio around various genetic componentry such as specialized vectors containing these genetic componentry and their use, with a last to expire patent in 2044. Although we have no certainty that these patents will 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.

We further 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 various aspects of intellectual property available to us.

Because we rely on trade secrets, know-how, and continuing technological advances to protect various aspects of our 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 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

With our diverse portfolio of proprietary technologies and novel therapeutic candidates, we are subject to significant and diverse regulations governing, among other things, 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, the products we are pursuing or are produced by us are subject to extensive regulation. We also 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 "We rely on third parties, including through collaborations, to develop and commercialize some of our product candidates. Markets in which our collaborators are developing product candidates using our technologies are subject to extensive regulation, and we rely on our collaborators to comply with all applicable laws and regulations."

Environmental regulations affecting us and our collaborators

We and our 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 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 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 which impact us and our collaborators. Our and our collaborators' processes may contain genetically engineered organisms which, when used in industrial processes, are considered new chemicals under the Toxic Substances Control Act program of the United States Environmental Protection Agency, or EPA. These laws and regulations would require us and our collaborators to obtain and comply with the EPA's Microbial Commercial Activity Notice process to operate. In the European Union, we and our 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

Governmental 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, approval, packaging, storage, recordkeeping, labeling, advertising, promotion, distribution, sale, marketing, import and export of therapeutic products such as those being developed by us and 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 and biological products 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 implementing regulations. The FDA licenses biological 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 applicable regulatory requirements, which may include the FDA's current Good Laboratory Practice regulations and the Animal Welfare Act;
- submission to the FDA of an 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 cGMP and that the methods and controls are adequate to assure 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.

Preclinical testing

Before testing any product candidate in humans in the United States, a company must develop preclinical data, generally including laboratory evaluation of the product candidate's chemistry and formulation, as well as toxicological and pharmacological studies in animal species to assess safety and quality. Certain types of animal studies must be conducted in compliance with the FDA's Good Laboratory Practice regulations and the Animal Welfare Act, which is enforced by the Department of Agriculture.

IND application

A person or entity sponsoring clinical trials in the United States to evaluate a product candidate's safety and effectiveness must submit to the FDA, prior to commencing such trials, an IND application, which contains preclinical testing results and other data and information that allow the FDA to evaluate whether there is an adequate basis for testing the drug in humans. If the FDA does not object to the IND application within 30 days of submission, the clinical testing proposed in the IND may begin. Even after the IND has gone into effect and clinical testing has begun, the FDA may put clinical trials on "clinical hold," suspending or, in some cases, ending them because of safety concerns or for other reasons.

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, such as GCP requirements. Each clinical trial must also be conducted under a protocol that details, among other things, the study objectives, parameters for monitoring safety, and the efficacy criteria, if any, to be evaluated. The protocol is submitted to the FDA as part of the IND and reviewed by the agency. 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. The sponsor of a clinical trial, the investigators, and IRBs each must comply with requirements and restrictions that govern, among other things, obtaining informed consent from each study subject, complying with the protocol and investigational plan, adequately monitoring the clinical trial, and timely reporting adverse events. Clinical trials involving recombinant or synthetic nucleic acid molecules, such as DNA, conducted at institutions that receive any funding from the National Institutes of Health 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.

The sponsor of a clinical trial or the sponsor's designated responsible party may be required to register certain information about the trial and disclose certain results on government or independent registry websites, such as *clinicaltrials.gov*.

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

- *Phase 1.* The product candidate is introduced into a small number of 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 with the target disease or disorder, often at geographically dispersed clinical trial sites, in adequate and well-controlled clinical trials to generate sufficient data to evaluate the safety and 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 profile 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 long-term follow-up measures to observe delayed adverse effects in subjects exposed to investigational gene therapies when the risk of such effects is not low or when the gene therapy utilizes genome-editing technology, shows signs of persistence, has the potential for latency and reactivation, or genetically alters the human genome.

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. When an application is submitted, the FDA makes an initial determination as to whether the application is sufficiently complete to be accepted for review. If the application is not, the FDA may refuse to accept the application for filing and request additional information. A refusal to file, which requires resubmission of the application with the requested additional information, delays review of the application. 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, certain marketing applications generally must contain data to assess the safety and effectiveness of the 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 postmarketing clinical trials designed 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.

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 application and may extend to requiring withdrawal of the product from the market.

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 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 may 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. Orphan drug designation does not, however, change the legal standard required for a product candidate to obtain FDA approval.

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, if nonclinical and clinical data demonstrate the product's potential to address unmet medical needs and the product is intended to treat a serious condition. 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.

Regenerative Medicine Advanced Therapy Designation

The FDA may grant regenerative medicine advanced therapy, or RMAT, designation to regenerative medicine therapies, which may include cell therapies, human gene therapies, therapeutic tissue engineering products, and human cell and tissue products, if certain criteria are met. In particular, a drug may be eligible for RMAT designation if the drug is a regenerative medicine therapy as defined in Section 506(g)(8) of the FDCA; the drug is intended to treat, modify, reverse, or cure a serious or life-threatening disease or condition; and preliminary clinical evidence indicates that the drug has the potential to address unmet medical needs for such disease and condition. The FDA must determine if the product candidate qualifies for RMAT designation within 60 days after receipt of the sponsor's request.

A grant of RMAT designation includes all of the benefits of Fast Track designation, intensive guidance on efficient drug development beginning as early as Phase 1, and organizational commitment involving senior managers. The RMAT 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 product, 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. Additionally, the FDA may require postmarketing studies or clinical trials, changes to a product's approved labeling, including the addition of new warnings and contraindications, or the implementation of other risk management measures, including distribution restrictions, if new safety information emerges. Failure to comply with the applicable requirements may result in administrative, judicial, civil or criminal actions and adverse publicity. These actions may include FDA's refusal to approve or delay in approving 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 twelve years of marketing exclusivity 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 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 may be 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 a product candidate, 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 drug 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 PGEN Therapeutics 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.

Anti-Kickback, False Claims, and Other Marketing and Fraud and Abuse Laws

Healthcare providers, physicians and others will play a primary role in the recommendation and prescription of any products for which we obtain marketing approval. Our future arrangements with healthcare providers, patients and third-party payers will expose us to broadly applicable United States fraud and abuse and other healthcare laws and regulations that may constrain the business or financial arrangements and collaborative partners through which we market, sell and distribute any products for which we obtain marketing approval. Restrictions under applicable federal and state healthcare laws and regulations are discussed in the "Risk Factors" section below.

Privacy Laws

In the United States, we may be subject to data privacy and security laws and regulations by both the federal government and the states in which we conduct our business. The legislative and regulatory landscape for privacy and data protection continues to evolve, and there has been an increasing focus on privacy and data protection issues which may affect our business. Numerous federal and state laws and regulations, including state data breach notification laws, state health information and/or genetic privacy laws and federal and state consumer protection laws (e.g., Section 5 of the Federal Trade Commission, or FTC, Act and the California Consumer Privacy Act, as amended by the California Privacy Rights Act, or CCPA), govern the collection, use, disclosure, protection and other processing of health-related and other personal information. Many of these laws differ from each other in significant ways and may not have the same effect, thus complicating compliance efforts. Compliance with these laws is difficult, constantly evolving, and time consuming. Federal regulators, state attorneys general, and plaintiffs' attorneys, including class action attorneys, have been and will likely continue to be active in this space.

The Health Insurance Portability and Accountability Act of 1996, or HIPAA, imposes requirements relating to the privacy, security and transmission of individually identifiable health information. We may obtain health information from third parties, such as research institutions, that are subject to privacy and security requirements under HIPAA. Although we are not directly subject to HIPAA other than with respect to providing certain employee benefits, we could potentially be subject to criminal penalties if we, our affiliates, or our agents knowingly obtain, use, or disclose individually identifiable health information maintained by a HIPAA-covered entity in a manner that is not authorized or permitted by HIPAA.

In addition, the CCPA establishes certain requirements for data use and sharing transparency, and provides California residents certain rights concerning the use, disclosure, and retention of their personal data. The CCPA and its implementing regulations have already been amended multiple times since their enactment. Similarly, there are a number of legislative proposals in the United States, at both the federal and state level that could impose new obligations or limitations in areas affecting our business. These laws and regulations are evolving and subject to interpretation, and may impose limitations on our activities or otherwise adversely affect our business. The CCPA and evolving legislation may require us, among other things, to update our notices and develop new processes internally and with our partners.

Internationally, laws and regulations in many jurisdictions also apply broadly to the collection, use, storage, disclosure, protection and other processing of data that identifies or may be used to identify or locate an individual. Please see the risk factor entitled “Failure to comply with current or future federal, state and foreign laws and regulations and industry standards relating to privacy and data protection laws could lead to governmental enforcement actions (which could include civil or criminal penalties), private litigation, and/or adverse publicity and could negatively affect our operating results and business.”

Healthcare Reform

In the United States and some foreign jurisdictions, there have been, and continue to be, a number of legislative and regulatory changes and proposed changes regarding the healthcare system that could, among other things, prevent or delay marketing approval of our product candidates, restrict or regulate post-approval activities, and affect our ability, or the ability of any collaborators, to profitably sell any products for which we, or they, obtain marketing approval. We expect that current laws, as well as other healthcare reform measures that may be adopted in the future, may result in more rigorous coverage criteria and in additional downward pressure on the price that we, or any collaborators, may receive for any approved products.

The Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act of 2010, or collectively, the Affordable Care Act, has substantially changed the way healthcare is financed by both governmental and commercial payers and significantly impacts the pharmaceutical industry. Certain provisions of the Affordable Care Act have been subject to judicial challenges, as well as efforts to repeal, replace, or otherwise modify them or to alter their interpretation or implementation. For example, the Tax Cuts and Jobs Act, or Tax Act, enacted on December 22, 2017 eliminated the tax-based payment for individuals who fail to maintain minimum essential coverage under section 5000A of the Internal Revenue Code of 1986, as amended, commonly referred to as the "individual mandate," effective January 1, 2019. Additional legislative changes, regulatory changes, and judicial challenges related to the Affordable Care Act remain possible. It is unclear how the Affordable Care Act and its implementation, as well as efforts to repeal, replace, or otherwise modify, or invalidate, the Affordable Care Act, or portions thereof, will affect our business.

In addition, other legislative changes have been proposed and adopted since the Affordable Care Act was enacted. For example, the Budget Control Act of 2011, as amended, among other things led to aggregate reductions in Medicare payments for all items and services, including prescription drugs and biologics, to service providers of, on average, 2 percent per fiscal year beginning April 1, 2013, and, due to subsequent legislation, continuing until 2030 (with the exception of a temporary suspension from May 1, 2020, through March 31, 2021) unless Congress takes additional action.

It is possible that the Affordable Care Act, as currently enacted or may be amended in the future, as well as other healthcare reform measures that may be adopted in the future, and their implementation may result in additional reductions in Medicare and other healthcare funding, more rigorous coverage criteria, and new payment methodologies and in additional downward pressure on coverage and payment and the price that we receive for any approved product. Any reduction in reimbursement from Medicare or other government programs may result in a similar reduction in payments from commercial payers. The implementation of cost containment measures or other healthcare reforms may prevent us from being able to generate revenue, attain profitability, or commercialize our products.

COVID-19 Impact

COVID-19 has had and continues to have an extensive impact on the global health and economic environments. The health and safety of our employees is of the utmost importance. We have implemented safety measures in our facilities for the well-being of our employees and visitors. These measures have permitted us to continue to advance our programs, with the ultimate goal of benefiting patients.

We experienced delays and suspensions in our trials in 2020 due to the COVID-19 pandemic and although these suspensions did not result in significant overall delay, there is uncertainty regarding the duration and severity of the ongoing pandemic, and we could experience further delays of other pandemic-related events that may adversely impact our clinical as well as preclinical pipeline candidates in the future. Notwithstanding the foregoing, as the COVID-19 pandemic continues to evolve, or if future pandemics occur, we may experience additional delays to our clinical trials, including related to enrollment, site closures, reduced availability of key personnel, or our ability to receive the necessary approvals from the FDA or other regulatory agencies to advance our programs.

We are also closely monitoring the impact of COVID-19 on other aspects of our business. While Exemplar has not experienced any significant impacts as a result of COVID-19 at this time, we are unable to reliably quantify or estimate what the future impacts may be.

Given the dynamic nature of these circumstances, the full impact of the COVID-19 pandemic on our ongoing business, results of operations, and overall financial performance cannot be reasonably estimated at this time. For more information regarding the risks associated with COVID-19 and its impact on our business, see "Risk Factors - Risks Related to Our Business."

Reportable Segments

As of December 31, 2022, our reportable segments were (i) Biopharmaceuticals and (ii) Exemplar. These identified reportable segments met the quantitative thresholds to be reported separately for the year ended December 31, 2022. See "Notes to the Consolidated Financial Statements - Note 18" appearing elsewhere in this Annual Report for a discussion of our reportable segments and Segment Adjusted EBITDA.

Research and Development

As of December 31, 2022, we had 138 employees supporting our research and development functions of our healthcare operations, including operational and facility activities. We incurred expenses of \$47.2 million, \$47.9 million and \$39.4 million in 2022, 2021, and 2020, respectively, on research and development activities for continuing operations. We anticipate that our research and development expenditures could increase as we advance our healthcare programs and platforms. As of December 31, 2022, our primary domestic research and development operations were located in laboratory facilities in Germantown, Maryland, and our primary international research and development operations were located in a laboratory facility in Ghent, Belgium.

Financial Information

Collaboration revenues, product revenues, service revenues and other revenues and operating loss for each of the last three fiscal years, along with assets as of December 31, 2022 and 2021, 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 18" appearing elsewhere in this Annual Report.

Human Capital Management

As of December 31, 2022, we had 209 employees in support of our healthcare operations, of which 138 support our research and development functions including operational and facility activities. Of these research and development employees, 66 have advanced degrees, of which 37 are PhDs. Our corporate employees provide support to all of our operating subsidiaries and are responsible for the execution of all corporate functions, including executive, operational, finance, human resources, information technology, legal, and corporate communications. None of our employees are represented by a collective bargaining agreement.

We structure our compensation packages to compete for the best scientific talent. Our compensation packages include a competitive base salary and bonus, the issuance of equity incentives, and health and wellness benefits, including a health insurance plan with a Platinum actuarial value.

We pride ourselves on a diverse workforce as evidenced by our international subsidiaries and 72% of our domestic employees identifying as ethnic, racial, and/or gender minorities. Worldwide 46% of our research and development employees are female.

Our 2022 employee development initiatives included employee training targeting specific areas of interest, executive and manager coaching, and performance management, which encompass performance goals and competency evaluations. We maintained our safety protocols in response to the COVID-19 pandemic including increased cleaning protocols, employee preventative measures, and contract tracing. As we have continued this commitment to our employees' health and safety into 2022, we have been able to maintain operations with no severe COVID outbreaks or company shutdowns.

Additional Information

Our website is www.precigen.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

Precigen 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.precigen.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.

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 and Capital Needs

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

We have incurred net losses since our inception. 2022 was an exception of \$28.3 million [in net income] due to the sale of TransOva but in 2021 and 2020 Precigen incurred net losses of \$92.2 million, and \$170.5 million, respectively. As of December 31, 2022, we had an accumulated deficit of \$1.9 billion. We expect to incur losses and negative cash flow from operating activities for the foreseeable future.

We anticipate that our expenses will increase substantially as we continue to advance the preclinical and clinical development of our existing product candidates and our research programs, and there is a significant risk that our product candidates will fail to demonstrate adequate efficacy or an acceptable safety profile, obtain regulatory approval, or become commercially viable. We expect a significant period of time could pass before commercialization of our various product candidates or before the achievement of contractual milestones and the realization of royalties on product candidates commercialized under our collaborations and revenues 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.

Our operations have consumed substantial amounts of cash since our inception. We expect to continue to spend substantial amounts to continue the preclinical and clinical development of our current and future programs. We are and will continue to be dependent on public or private financings, new collaborations or licensing arrangements with strategic partners, or additional debt financing sources to fund continuing operations. We expect our future capital requirements will be substantial and will depend on many factors, including:

- progress in our research and development programs, as well as the magnitude of these programs;
- the timing of potential regulatory approval of products of our collaborations and operations;
- the timing, receipt, and amount of any payments received in connection with strategic transactions;
- the timing, receipt, and amount of sales and royalties, if any, from our product candidates;

- the timing and capital requirements to scale up our various product candidates and service offerings and customer acceptance thereof;
- our ability to maintain and establish additional collaborative arrangements and/or new strategic initiatives;
- the resources, time, and cost required for the preparation, filing, prosecution, maintenance, and enforcement of our intellectual property portfolio;
- strategic mergers and acquisitions, if any, 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.

We recently raised approximately \$73.0 million in net proceeds in an offering of equity securities in January 2023. If future financings involve the issuance of equity securities, including pursuant to our at-the-market program pursuant to which we may issue and sell from time to time shares of our common stock of up to \$100 million, 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 product candidates 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 product candidates resulting from our technologies, curtail or cease operations or obtain funds through strategic transactions 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. In addition, raising funds in the current economic environment may present additional challenges. For example, any sustained disruption in the capital markets from adverse macroeconomic conditions, such as the disruption and uncertainty caused by rising inflation, increasing interest rates and slower economic growth or recession, could negatively impact our ability to raise capital and we cannot predict the extent or duration of such macro-economic disruptions. If adequate funds are not available, we will not be able to successfully execute our business plan or continue our business.

We may incur substantially more debt or take other actions that would intensify the risks discussed above.

While we intend to repay the existing Convertible Notes, 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, including additional convertible 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.

Failure of the U.S. federal government to manage its fiscal matters or to raise or further suspend the debt ceiling may expose us to increased financial and operational risk.

On January 19, 2023, the U.S. federal government reached its limit on the level of federal debt that it can have outstanding, often referred to as the debt ceiling, and currently faces risk of defaulting on its debt. This risk has caused the U.S. Department of the Treasury, or the U.S. Treasury, to take extraordinary measures to avoid default. However, the U.S. Treasury expects to exhaust these measures by early June 2023, and if U.S. lawmakers do not pass legislation to raise the debt ceiling by such time, it is possible that the U.S. could default on its debt obligations. If the U.S. federal government is unable to reach agreement regarding raising the statutory ceiling, in a timely manner or at all, this may have negative consequences for the Company. Potential impacts to our business may include:

- devaluation in any U.S. government bond investments held by the Company;
- inability to access capital markets, or increased difficulty in doing so; or
- government shutdown, or reduced operation, of agencies such as the FDA, which could impede our ability to progress our planned clinical development of product candidates.

Risks Related to the Discovery and Development of our Product Candidates

Our business is dependent on our ability to advance our current and future product candidates through clinical trials, obtain marketing approval, and ultimately commercialize them.

We are early in our development efforts. We initiated our first clinical trial for our lead programs in October 2018, and currently have a pipeline of preclinical programs. Our ability to generate product revenues, which we do not expect will occur for several years, if ever, will depend heavily on the successful development and eventual commercialization of some or all of these product candidates, and any future product candidates we develop, which may never occur. Our current and future product candidates will require additional preclinical or clinical development, management of clinical, preclinical and manufacturing activities, marketing approval in the United States and other jurisdictions, coverage from pricing and reimbursement authorities, sufficient cGMP manufacturing supply for both preclinical and clinical development and commercial production, building of a commercial organization and substantial investment, and significant marketing efforts before we generate any revenues from product sales.

The clinical and commercial success of our current and future product candidates will depend on several factors, including the following:

- sufficiency of our financial and other resources to complete the necessary preclinical studies and clinical trials;
- timely and successful completion of preclinical studies and clinical trials;
- acceptance of INDs for future product candidates;
- successful enrollment in and completion of clinical trials;
- data from our clinical programs that supports an acceptable risk-benefit profile of our product candidates in the intended patient populations;
- our ability to consistently manufacture our product candidates on a timely basis or to establish agreements with third-party manufacturers that can do so;
- whether we are required by the FDA or comparable foreign regulatory authorities to conduct additional clinical trials or other studies beyond those planned or anticipated to support approval of our product candidates;
- acceptance of our proposed indications and the primary endpoint assessments evaluated in the clinical trials of our product candidates by the FDA and comparable foreign regulatory authorities;
- receipt and maintenance of timely marketing approvals from applicable regulatory authorities;
- the successful launch of commercial sales of our product candidates, if approved;
- the prevalence, duration and severity of potential side effects or other safety issues experienced with our product candidates, if approved;
- entry into collaborations to further the development of our product candidates;
- our ability to obtain and maintain patent and other intellectual property protection or regulatory exclusivity for our product candidates;
- acceptance of the benefits and uses of our product candidates, if approved, by patients, the medical community, and third-party payers;
- maintenance of a continued acceptable safety, tolerability and efficacy profile of the product candidates following approval;
- our compliance with any post-approval requirements imposed on our products, such as postmarketing studies, a REMS, or additional requirements that might limit the promotion, advertising, distribution or sales of our products or make the products cost prohibitive;
- our ability to compete effectively with other therapies; and

- our ability to obtain and maintain healthcare coverage and adequate reimbursement from third-party payers.

These factors, many of which are beyond our control, could cause us to experience significant delays or an inability to obtain regulatory approvals or commercialize our current or future product candidates, and could otherwise materially harm our business. Successful completion of preclinical studies and clinical trials does not mean that any of our current or future product candidates will receive regulatory approval. Even if regulatory approvals are obtained, we could experience significant delays or an inability to successfully commercialize our current and any future product candidates, which would materially harm our business. If we are not able to generate sufficient revenue through the sale of any current or future product candidate, we may not be able to continue our business operations or achieve profitability.

The market opportunities for our product candidates may be smaller than we estimate.

Our projections of both the number of people who have the diseases we are targeting, as well as the subset of people with these diseases who are in a position to receive our product candidates, and who have the potential to benefit from treatment with our product candidates, are based on our own estimates. These estimates may be inaccurate or based on imprecise data. We do not have verifiable internal marketing data regarding the potential size of the commercial market for any of our product candidates, nor have we obtained current independent marketing surveys to verify the potential size of the commercial markets for our current product candidates or any future product candidates. Since our current product candidates and any future product candidates will represent novel approaches to treating various conditions, it may be difficult, in any event, to accurately estimate the potential revenues from these product candidates.

For example, our estimates of the number of people who have recurrent respiratory papillomatosis, or RRP, the target indication for PRGN-2012, is based on our own internal estimates including, commissioned research which reviewed a variety of sources, including scientific literature, surveys of patients, analogous products based on disease severity, prevalent population and efficacy of therapy and other forms of market research. These estimates may be inaccurate or based on imprecise data. As RRP is a rare disease and there are currently no approved therapeutics for RRP, limited research is available regarding its prevalence and market opportunity for a therapeutic. In addition, the addressable market opportunity for PRGN-2012 will depend on, among other things, the final labeling for PRGN-2012 as agreed with the U.S. Food and Drug Administration or comparable regulatory authorities in other jurisdictions, acceptance by the medical community and patient access and drug pricing and reimbursement. The number of patients in the addressable markets may turn out to be lower than expected, patients may not be otherwise amenable to treatment with our product candidate or new patients may become increasingly difficult to identify or gain access to, all of which could materially adversely affect our business, financial condition, results of operations and prospects.

The regulatory approval processes of the FDA and comparable foreign authorities are lengthy, time-consuming, and inherently unpredictable, and if we are ultimately unable to obtain regulatory approval for our product candidates, our business will be materially harmed.

The time required to obtain approval by the FDA and comparable foreign authorities is unpredictable but typically takes many years following the commencement of clinical trials and depends upon numerous factors, including the substantial discretion of the regulatory authorities. There can be no assurance that we 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 delay or prevent the completion of clinical trials and the commercializing of product candidates 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, which may prolong the period of observation required for obtaining regulatory approval, may necessitate additional clinical testing, or may otherwise result in a change in the requirements for approval of any of our product candidates.

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 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 jurisdictions outside the United States 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 Tissues and Advanced Therapies and the Division of Cellular 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.

We may be unable to obtain FDA approval of our product candidates under applicable regulatory requirements. The denial or delay of any such approval would prevent or delay commercialization of our product candidates and adversely impact our potential to generate revenue, our business, and our results of operations.

To gain approval to market our product candidates in the United States, we must provide the FDA with clinical data that adequately demonstrate the safety, purity, and potency, including efficacy, of the product candidate for the proposed indication or indications in a BLA submission. Product development is a long, expensive, and uncertain process, and delay or failure can occur at any stage of any of our clinical development programs.

The field of gene therapy is still early in development. The FDA first approved a gene therapy for use in humans in 2017, and to date has only approved a limited number. 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 will be timely or successful, that we or our collaborators will receive the regulatory approvals necessary to initiate clinical trials, where applicable, or that we will ever be able to successfully commercialize a product candidate enabled by our technologies. To the extent that we 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 product candidates.

Additionally, we are pursuing the development and commercialization of adoptive cell therapies based on CAR T-cell therapies targeting a variety of cancer malignancies. Because this is a newer approach to cancer immunotherapy and cancer treatment generally, developing and commercializing such product candidates subjects us to a number of challenges, including:

- 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 product candidates, 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, misappropriating or otherwise violating 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 that we may develop will yield satisfactory products that are safe and effective, scalable, or profitable.

Clinical development involves a lengthy and expensive process with uncertain outcomes. We may incur additional costs and experience delays in developing and commercializing or be unable to develop or commercialize our current and future product candidates.

Clinical development involves a lengthy and expensive process with uncertain outcomes. 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 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 failure 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 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 may decide, or regulators may require us, to discontinue trials of the product candidates or conduct additional clinical trials or preclinical studies.

As an organization, we have limited experience designing and implementing clinical trials and we have never conducted pivotal clinical trials. Failure to adequately design a trial, or incorrect assumptions about the design of the trial, could adversely affect our ability to initiate the trial, enroll patients, complete the trial, or obtain regulatory approval on the basis of the trial results, as well as lead to increased or unexpected costs and delayed timelines.

The design and implementation of clinical trials is a complex process. We have limited experience designing and implementing clinical trials, and we may not successfully or cost-effectively design and implement clinical trials that achieve our desired clinical endpoints efficiently, or at all. A clinical trial that is not well designed may delay or even prevent initiation of the trial, can lead to increased difficulty in enrolling patients, may make it more difficult to obtain regulatory approval for the product candidate on the basis of the study results, or, even if a product candidate is approved, could make it more difficult to commercialize the product successfully or obtain reimbursement from third-party payers. Additionally, a trial that is not well-designed could be inefficient or more expensive than it otherwise would have been, or we may incorrectly estimate the costs to implement the clinical trial, which could lead to a shortfall in funding.

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

Identifying and qualifying patients to participate in clinical trials of our 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 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. Additionally, any shelter-in-place orders from local, state, or federal governments or clinical trial site policies resulting from the COVID-19 pandemic may impact our ability to enroll patients in clinical trials. These delays could result in increased costs, delays in advancing product candidates, or termination of the clinical trials altogether.

We may be required to suspend, repeat, or terminate our clinical trials if they are not conducted in accordance with regulatory requirements, or the trials are not well designed.

Clinical trials must be conducted in accordance with the FDA's current good clinical practices requirements or analogous requirements of applicable foreign regulatory authorities. Clinical trials are subject to oversight by the FDA, other foreign governmental agencies and IRBs, or ethical committees at the study sites where the clinical trials are conducted. In addition, clinical trials must be conducted with product candidates manufactured in accordance with applicable cGMP. Clinical trials may be suspended by the FDA, other foreign regulatory authorities, us, or by an IRB or ethics committee with respect to a particular clinical trial site, for various reasons, including:

- deficiencies in the conduct of the clinical trials, including failure to conduct the clinical trial in accordance with regulatory requirements or study protocols;
- deficiencies in the clinical trial operations or trial sites;

- unforeseen adverse side effects or the emergence of undue risks to study subjects;
- deficiencies in the trial design necessary to demonstrate efficacy;
- the product candidate may not appear to offer benefits over current therapies; or
- the quality or stability of the product candidate may fall below acceptable standards.

If we experience delays in the completion of, or the termination of, any clinical trial of any of our product candidates, the commercial prospects of such product candidate will be harmed, and our ability to generate product revenues from such product candidate will be delayed. In addition, any delays in completing our clinical trials will increase our costs, slow down our product candidate development and approval process, and jeopardize our ability to commence product sales and generate revenues. Any of these occurrences may harm our business, financial condition, results of operations, cash flows, and prospects significantly. In addition, many of the factors that cause, or lead to, a delay in the commencement or completion of clinical trials may also ultimately lead to the denial of regulatory approval of our product candidates.

Cell and gene therapies are novel, complex, and difficult to manufacture.

The manufacturing processes that we use to produce our 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. Our 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 have developed our proprietary electroporation device, UltraPorator, to permit the rapid and cost-effective manufacturing of our UltraCAR-T therapies, but we may face challenges in the production and implementation of this device, which may, in turn, adversely impact the therapeutic candidates. We 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.

Interim and preliminary results from our clinical trials that we announce or publish from time to time may change as more patient data become available and are subject to audit, validation, and verification procedures that could result in material changes in the final data.

From time to time, we may publish interim data, including interim top-line results or preliminary results from our clinical trials. Interim data and results from our clinical trials are subject to the risk that one or more of the clinical outcomes may materially change as patient enrollment continues and more patient data become available. Preliminary or top-line results also remain subject to audit, validation, and verification procedures that may result in the final data being materially different from the interim and preliminary data we previously published. As a result, interim and preliminary data may not be predictive of final results and should be viewed with caution until the final data are available. Differences between preliminary or interim data and final data could significantly harm our business prospects and may cause the trading price of our common stock to fluctuate significantly.

Our product candidates may cause undesirable side effects or have other properties that could halt their clinical development, delay or prevent their regulatory approval, limit their commercial potential, or result in significant negative consequences.

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. While new approaches have been developed to reduce these side effects, gene therapy and synthetic biology therapy in general is still a relatively new approach to disease treatment and additional adverse side effects could develop. There also is the potential risk of delayed adverse events following exposure to these product candidates due to persistent biological 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 using cell and gene therapy 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 a similar effect occurs with our product candidates, we may decide or be required to halt or delay further clinical development of our product candidates.

Additionally, if any of our product candidates receive 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, a communication plan to healthcare practitioners, and provider certification. 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.

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

We 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 clinical trial results may not support approval of our product candidates if they fail to demonstrate that our product candidates are both safe and effective for their intended uses. Similarly, the regulatory authorities 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 contraindications with respect to conditions of use or they may grant approval subject to the performance of costly postmarketing 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.

We have chosen to prioritize development of certain of our product candidates. We may expend our limited resources on product candidates or indications that do not yield a successful product and fail to capitalize on other opportunities for which there may be a greater likelihood of success or may be more profitable.

Because we have limited resources, we are required to strategically 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.

The ongoing COVID-19 pandemic could cause a disruption of the development of our product candidates, which could adversely impact our healthcare business.

As the COVID-19 pandemic continues to evolve, we may experience delays in the development of our product candidates, including as a result of declines in new patient enrollment for new and existing trials, ability to recruit and retain principal investigators and site staff who, as healthcare providers, may have heightened exposure to COVID-19 if an outbreak occurs in their geography, site closures, reduced availability of other key personnel, availability of supplies, or for other reasons that may be difficult to anticipate. In addition, the FDA or other regulatory authorities may have their resources diverted to responding to, or otherwise may be disrupted by, the COVID-19 pandemic, which could result in delays of reviews, approvals, and communications with regulatory authorities related to our clinical trials and product candidates. As the focus of our business is on healthcare, disruptions to our clinical trials could result in increased costs, delays in advancing product candidates, or ultimately, termination of clinical trials altogether resulting in a material adverse impact to our overall business. Furthermore, a failure to achieve meaningful clinical trial results, or even progress toward those results, could have a material adverse effect on the value of our securities and our ability to secure needed additional capital.

Risks Related to the Commercialization of Product Candidates and Other Legal Compliance Matters

Even if a current or future product candidate receives marketing approval, it may fail to achieve the degree of market acceptance by physicians, patients, third-party payers, and others in the medical community necessary for commercial success.

Ethical, social, and legal concerns about gene and cell therapies could result in additional regulations restricting or prohibiting our product candidates. 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 our product candidates will depend, in part, on their acceptance by physicians, patients, and healthcare payers as medically necessary, cost-effective, and safe. Public perception

may be influenced by claims that gene and cell therapies are unsafe, and any product candidate that we commercialize may not gain acceptance by physicians, patients, healthcare payers, and others in the medical community. In particular, our success will depend upon appropriate physicians prescribing treatments that involve the use of our product candidates in lieu of, or in addition to, existing treatments they are already familiar with and for which greater clinical data may be available. If these products do not achieve an adequate level of acceptance, we may not generate significant product revenue to make the products profitable.

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

Before we 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.

Even if we receive marketing approval of a product candidate, we will be subject to ongoing regulatory obligations and continued regulatory review, which may result in significant additional expense. If we fail to comply or experience unanticipated problems with our products, we may be subject to administrative and judicial enforcement, including monetary penalties, for non-compliance and our approved products, if any, could be deemed misbranded or adulterated and prohibited from continued distribution.

Even if we 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 postmarket 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 postmarketing 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. 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. Drug manufacturers are subject to ongoing periodic unannounced inspection by the FDA and other government agencies to ensure compliance with cGMP and other government regulations and corresponding foreign standards. We do not have control over third-party manufacturers' compliance with these regulations and standards, but we may ultimately be responsible for any of their failures.

If we fail to comply with applicable regulatory requirements following approval of any of our product candidates, a regulatory authority may take a range of adverse actions, including, among other things, issuing a warning letter, imposing monetary penalties, restricting or suspending manufacturing, or 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.

Obtaining and maintaining marketing approval of our current and future product candidates in one jurisdiction does not mean that we will be successful in obtaining and maintaining marketing approval of our current and future product candidates in other jurisdictions.

Obtaining and maintaining marketing approval of our current and future product candidates in one jurisdiction does not guarantee that we will be able to obtain or maintain marketing approval in any other jurisdiction, while a failure or delay in obtaining marketing approval in one jurisdiction may have a negative effect on the marketing approval process in others. For example, even if the FDA grants marketing approval of a product candidate, comparable regulatory authorities in foreign jurisdictions must also approve the manufacturing, marketing, and promotion of the product candidate in those countries. Approval procedures vary among jurisdictions and can involve requirements and administrative review periods different from, and greater than, those in the United States, including additional preclinical studies or clinical trials conducted in one jurisdiction may not be accepted by regulatory authorities in other jurisdictions. In many jurisdictions outside the United States, a product candidate must be approved for reimbursement before it can be approved for sale in that jurisdiction. In some cases, the price that we intend to charge for our products is also subject to approval.

We may also submit marketing applications in other countries. Regulatory authorities in jurisdictions outside of the United States have requirements for approval of product candidates with which we must comply prior to marketing in those jurisdictions. Obtaining foreign marketing approvals and compliance with foreign regulatory requirements could result in significant delays, difficulties and costs for us and could delay or prevent the introduction of our products in certain countries. If we fail to comply with the regulatory requirements in international markets or fail to receive applicable marketing approvals, our target market will be reduced and our ability to realize the full market potential of our product candidates will be harmed.

As a company, we have never commercialized a product, we currently have no active sales force or commercial infrastructure and we may lack the necessary expertise, personnel and resources to successfully commercialize our product candidates.

As a company, we have never commercialized a product for any indication. Even if we receive regulatory approval for one or more of our product candidates from the FDA or comparable regulatory authorities, we will need to develop robust internal sales, marketing and distribution capabilities to commercialize such products, which will be expensive and time-consuming, or enter into collaborations with third parties to perform these services.

We currently have no active sales force or commercial infrastructure. There are costs and risks involved with establishing our own sales, marketing and distribution capabilities. For example, recruiting and training a sales force is expensive and time-consuming and could delay any product launch. If the commercial launch of a product candidate for which we recruit a sales force and establish marketing capabilities is delayed or does not occur for any reason, we would have prematurely or unnecessarily incurred these commercialization expenses. This may be costly, and our investment would be lost if we cannot retain or reposition our sales and marketing personnel. We must also compete with other biotechnology companies to recruit, hire, train and retain marketing and sales personnel.

Alternatively, we may wish to establish collaborations with third parties to maximize the potential of our product candidates jurisdictions in which a product candidate has been approved. Our industry is characterized by intense competition. Therefore, we may not be successful in entering into such commercialization arrangements with third parties on favorable terms, or at all. In addition, we may have limited control over such third parties, and any of them may fail to devote the necessary resources and attention to sell, market and distribute our products effectively.

There can be no assurance that we will be able to develop the necessary commercial infrastructure and capabilities to successfully commercialize our product candidates or be able to establish or maintain relationships with third parties necessary to perform these services. As a result, we may not successfully commercialize any product in any jurisdiction.

The successful commercialization of our product candidates will depend in part on the extent to which third-party payers, including governmental authorities and private health insurers, provide coverage and adequate reimbursement levels, as well as implement pricing policies favorable for our product candidates. Failure to obtain or maintain coverage and adequate reimbursement for our product candidates, if approved, could limit our ability to market those products and decrease our ability to generate revenue.

The availability of coverage and adequacy of reimbursement by third-party payers, including managed care plans, governmental healthcare programs, such as Medicare and Medicaid and private health insurers is essential for most patients to be able to afford medical services and pharmaceutical products such as our product candidates that receive FDA approval. Our ability to achieve acceptable levels of coverage and reimbursement for our product candidates or procedures using our product candidates

by third-party payers will have an effect on our ability to successfully commercialize our product candidates. Obtaining coverage and adequate reimbursement for our product candidates may be particularly difficult because of the higher prices often associated with drugs administered under the supervision of a physician. Separate reimbursement for the product itself or the treatment or procedure in which our product candidate is used may not be available. A decision by a third-party payer not to cover or not to separately reimburse for our product candidates or procedures using our product candidates could reduce physician utilization of our products once approved. Assuming there is coverage for our product candidates, or procedures using our product candidates by a third-party payer, the resulting reimbursement payment rates may not be adequate or may require co-payments that patients find unacceptably high. We cannot be sure that coverage and reimbursement in the United States, the European Union, or elsewhere will be available for our current or future product candidates, or for any procedures using such product candidates, and any reimbursement that may become available may not be adequate or may be decreased or eliminated in the future.

There is significant uncertainty related to the insurance coverage and reimbursement of newly-approved products. The Medicare and Medicaid programs are increasingly used as models in the United States for how private third-party payers and other governmental payers develop their coverage and reimbursement policies for drugs and biologics. Some third-party payers may require pre-approval of coverage for new or innovative devices or drug therapies before they will reimburse healthcare providers who use such therapies. We cannot predict at this time what third-party payers will decide with respect to the coverage and reimbursement for our product candidates.

No uniform policy for coverage and reimbursement for products exist among third-party payers in the United States. Therefore, coverage and reimbursement for products can differ significantly from payer to payer. As a result, the coverage determination process is often a time-consuming and costly process that may require us to provide scientific and clinical support for the use of our product candidates to each payer separately, with no assurance that coverage and adequate reimbursement will be applied consistently or obtained in the first instance. Furthermore, rules and regulations regarding reimbursement change frequently, in some cases on short notice, and we believe that changes in these rules and regulations are likely.

Moreover, increasing efforts by third-party payers in the United States and abroad to cap or reduce healthcare costs may cause such organizations to limit both coverage and the level of reimbursement for newly approved products and, as a result, they may not cover or provide adequate payment for our product candidates. We expect to experience pricing pressures in connection with the sale of our product candidates due to the trend toward managed healthcare, the increasing influence of health maintenance organizations and additional legislative changes. The downward pressure on healthcare costs in general, particularly prescription drugs and biologics and surgical procedures and other treatments, has become intense. As a result, increasingly high barriers are being erected to the entry of new products.

Our business may be adversely affected by current and potential future healthcare reforms.

In the United States, federal and state legislatures, health agencies and third-party payers continue to focus on containing the cost of health care. Legislative and regulatory proposals and enactments to reform health care insurance programs could significantly influence the manner in which our product candidates, if approved, are prescribed and purchased. For example, the Affordable Care Act has changed the way health care is paid for by both governmental and private insurers, including increased rebates owed by manufacturers under the Medicaid Drug Rebate Program, annual fees and taxes on manufacturers of certain branded prescription drugs, the requirement that manufacturers participate in a discount program for certain outpatient drugs under Medicare Part D and the expansion of the number of hospitals eligible for discounts under Section 340B of the Public Health Service Act. In addition, the Tax Act eliminated the tax-based shared responsibility payment for individuals who fail to maintain minimum essential coverage under section 5000A of the Code, commonly referred to as the "individual mandate," effective January 1, 2019. Further, the Bipartisan Budget Act of 2018, among other things, amended the Medicare statute to reduce the coverage gap in most Medicare drug plans, commonly known as the "donut hole," by raising the required manufacturer point-of-sale discount from 50 percent to 70 percent off the negotiated price effective as of January 1, 2019.

Significant developments that may adversely affect pricing in the United States include proposed drug pricing and Medicare reforms by Congress and regulatory changes to Medicare Part B and Medicare Part D, additional changes to the Affordable Care Act under the Biden Administration and trends in the practices of managed care groups and institutional and governmental purchasers, including consolidation of our customers. The Coronavirus Aid, Relief and Economic Security Act ("CARES Act"), which was signed into law in March 2020 and is designed to provide financial support and resources to individuals and businesses affected by the COVID-19 pandemic, suspended the 2 percent Medicare sequester from May 1, 2020 through December 31, 2020, and extended the sequester by one year, through 2030.

The pharmaceutical industry faces uncertainty regarding the continuation of Medicare's current drug pricing methodology. For example, on November 27, 2020 the Centers for Medicare & Medicaid Services ("CMS"), published an Interim Final Rule ("IFR") that would have imposed a mandatory Most Favored Nation ("MFN") pricing model on the fifty single-source drugs and biologics (including biosimilars) with the highest annual Medicare Part B spending for seven years, beginning January 1, 2021. The MFN model would have ultimately based payment for each of the fifty drugs on the lowest-available, gross domestic product ("GDP")-adjusted drug price available in any Organization for Economic Co-operation and Development country that meets minimum GDP requirements. Pharmaceutical and biotechnology industry organizations as well as several patient support groups filed litigation to enjoin implementation of the IFR. On December 28, 2020, the United States District Court for the Northern District of California imposed a nationwide preliminary injunction on implementation of the IFR pending CMS's completion of regulatory notice-and-comment rulemaking by CMS. On December 29, 2021, CMS published a final rule that rescinded the IFR, effective February 28, 2022, to address the procedural issues acknowledged in the preliminary injunction. Although the IFR as published will not go into effect, CMS could propose future pharmaceutical pricing changes similar to the IFR, albeit with the required notice and opportunity for stakeholders to participate in the regulatory process.

On November 19, 2021, the United States House of Representatives passed the Build Back Better Act, which includes several provisions aimed at lowering prescription drug costs and reducing spending by the federal government and private payers by, among other things, allowing the United States federal government to negotiate prices for certain high-cost drugs covered under Medicare, imposing rebates on manufacturers of single-source drugs and biologics covered by Medicare Part B and nearly all drugs covered under Part D, if drug prices increase faster than the rate of inflation, based on the Consumer Price Index for All Urban Consumers ("CPI-U"). We are actively monitoring legislative developments to understand the likelihood of enactment and how such legislation would impact our business and operations, if enacted.

There is also significant economic pressure on state budgets that may result in states increasingly seeking to achieve budget savings through mechanisms that limit coverage or payment for certain drugs. In recent years, some states have considered legislation and ballot initiatives that would control the prices of drugs, including laws to allow importation of pharmaceutical products from lower cost jurisdictions outside the United States and laws intended to impose price controls on state drug purchases. State Medicaid programs are increasingly requesting manufacturers to pay supplemental rebates and requiring prior authorization by the state program for use of any drug for which supplemental rebates are not being paid. Government efforts to reduce Medicaid expenses may lead to increased use of managed care organizations by Medicaid programs. This may result in managed care organizations influencing prescription decisions for a larger segment of the population and a corresponding constraint on prices and reimbursement for our product candidates, if approved. In addition, under the Affordable Care Act, as states implement their health care marketplaces or operate under the federal exchange, the impact on drug manufacturers will depend in part on the formulary and benefit design decisions made by insurance sponsors or plans participating in these programs.

We cannot predict the likelihood, nature, or extent of government regulation that may arise from future legislation or administrative action in the United States. It is possible that we may need to provide discounts or rebates to such plans in order to maintain favorable formulary access for our future product candidates, if approved, which could have an adverse impact on our sales and results of operations. In addition, if we or any third parties we may engage are slow or unable to adapt to changes in existing requirements or the adoption of new requirements or policies, or if we or such third parties are not able to maintain regulatory compliance, our product candidates may lose any regulatory approval that may have been obtained.

Our relationships with customers, third-party payers, and others may be subject to applicable anti-kickback, fraud and abuse and other healthcare laws and regulations, which could expose us to criminal sanctions, civil penalties, contractual damages, reputational harm, administrative burdens and diminished profits and future earnings.

Healthcare providers, physicians, and third-party payers will play a primary role in the recommendation and prescription of any product candidates for which we obtain marketing approval. Our arrangements with third-party payers and customers may expose us to broadly applicable fraud and abuse and other healthcare laws and regulations that may constrain the business or financial arrangements and relationships through which we market, sell and distribute any products for which we obtain marketing approval. Restrictions under applicable federal and state healthcare laws and regulations, include, but are not limited to, the following:

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

- the federal civil False Claims Act, which imposes liability, including through civil whistleblower or qui tam actions, against individuals or entities for knowingly presenting, or causing to be presented, claims for payment of governmental funds that are false or fraudulent, making a false statement material to an obligation to pay money to the federal government, or knowingly concealing or knowingly and improperly avoiding, decreasing, or concealing an obligation to pay money to the federal government;
- HIPAA's fraud provisions, which impose criminal liability for knowingly and willfully executing a scheme to defraud any healthcare benefit program, knowingly and willfully embezzling or stealing from a healthcare benefit program, willfully obstructing a criminal investigation of a health care offense, or knowingly and willfully making false statements relating to healthcare matters;
- the federal Physician Payment Sunshine Act, being implemented as the Open Payments Program, which requires manufacturers of drugs, devices, biologics, and medical supplies for which payment is available under Medicare, Medicaid or the Children's Health Insurance Program (with certain exceptions) to report annually to CMS information related to direct or indirect payments and other transfers of value to physicians and teaching hospitals, as well as ownership and investment interests held in the company by physicians and their immediate family members. Beginning in 2022, applicable manufacturers are now required to report information regarding payments and transfers of value provided to physician assistants, nurse practitioners, clinical nurse specialists, certified nurse anesthetists, and certified nurse-midwives; and
- analogous state and foreign laws and regulations, such as state anti-kickback and false claims laws, which may apply to items or services reimbursed by non-governmental third-party payers, including private insurers; state and foreign laws that require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government or otherwise restrict payments that may be made to healthcare providers in those jurisdictions; state and foreign laws that require drug manufacturers to report information related to payments and other transfers of value to physicians and other healthcare providers or marketing expenditures; some states also prohibit certain marketing-related activities including the provision of gifts, meals, or other items to certain health care providers, and others restrict the ability of manufacturers to offer co-pay support to patients for certain prescription drugs; other states and cities require identification or licensing of sales representatives; and state and foreign laws that govern the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

Efforts to ensure that our business arrangements with third parties will comply with applicable healthcare laws and regulations will involve substantial costs. Although compliance programs can help mitigate the risk of investigations and prosecution for violations of these laws, the risks cannot be eliminated entirely. It is possible that governmental authorities will conclude that our business practices may not comply with current or future statutes, regulations, or case law interpreting applicable fraud and abuse or other healthcare laws and regulations. If our operations are found to be in violation of any of these laws or any other governmental regulations that may apply to us, we may be subject to significant civil, criminal and administrative penalties, damages, fines, imprisonment, exclusion from government funded healthcare programs, such as Medicare and Medicaid, and the curtailment or restructuring of our operations.

Defending against actions or investigations for violations of these laws and regulations, even if ultimately successful, will incur significant legal expenses and divert management's attention from the operation of our business.

Failure to comply with current or future federal, state and foreign laws and regulations and industry standards relating to privacy and data protection laws could lead to governmental enforcement actions (which could include civil or criminal penalties), private litigation, and/or adverse publicity and could negatively affect our operating results and business.

We or our collaborators may be subject to federal, state and foreign data privacy and security laws and regulations. In the United States, numerous federal and state laws and regulations, including federal health information privacy laws, state data breach notification laws, state health information privacy laws, and federal and state consumer protection laws, that govern the collection, use, disclosure, protection and other processing of health-related and other personal information could apply to our operations or the operations of our collaborators. Many state legislatures have adopted legislation that regulates how businesses operate online, including measures relating to privacy, data security and data breaches. Laws in all 50 states require businesses to provide notice to customers whose personally identifiable information has been disclosed as a result of a data breach. The laws are not consistent, and compliance in the event of a widespread data breach is costly. For example, the CCPA imposes stringent data privacy and data protection requirements for the personal information of California residents, provides for civil

penalties for violations, as well as a private right of action for data breaches. The CCPA and evolving legislation may require us, among other things, to incur additional costs and expenses in an effort to comply.

Foreign data protection laws, including the European Union, or EU, General Data Protection Regulation, or the GDPR, may also apply to health-related and other personal information obtained outside of the United States. The GDPR introduced new data protection requirements in the EU, as well as potential fines for noncompliant companies of up to the greater of €20 million or 4 percent of annual global revenue. Among other requirements, the GDPR regulates transfers of personal data subject to the GDPR to third countries that have not been found to provide adequate protection to such personal data, including the United States, and the efficacy and longevity of current transfer mechanisms between the EU and the United States remains uncertain.

Further, the vote in the United Kingdom in favor of exiting the EU, referred to as Brexit, has created uncertainty with regard to data protection regulation in the United Kingdom. The United Kingdom has transposed the GDPR into domestic law with a United Kingdom version of the GDPR, or the U.K. GRPD, which took effect in January 2021, and could expose us to two parallel regimes, each of which potentially authorizes similar fines and other potentially divergent enforcement actions for violations. The GDPR and U.K. GDPR also impose strict rules on the transfer of personal data to countries outside the European Economic Area or the United Kingdom, respectively, including the United States. The European Commission has adopted an adequacy decision in favor of the United Kingdom, enabling data transfers from the European Economic Area to the United Kingdom without additional safeguards. However, the United Kingdom adequacy decision will automatically expire in June 2025 unless the European Commission re-assesses and renews or extends that decision. We and many other companies may need to implement different or additional measures (such as the recently revised European Commission-approved Standard Contractual Clauses or the U.K. Government-approved International Data Transfer Agreement) to establish or maintain legitimate means for the transfer and receipt of personal data from the European Economic Area and the United Kingdom to the United States.

Compliance with United States and foreign data protection laws and regulations could require us to take on more onerous obligations in our contracts; restrict our ability to collect, use, and disclose data; or in some cases, impact our ability to operate in certain jurisdictions. Failure by us or our collaborators to comply with United States and foreign data protection laws and regulations could result in government enforcement actions (which could include civil or criminal penalties), private litigation and/or adverse publicity and could negatively affect our operating results and business. Moreover, clinical trial subjects about whom we or our potential collaborators obtain information, as well as the providers who share this information with us, may contractually limit our ability to use and disclose the information. Claims that we have violated individuals' privacy rights, failed to comply with data protection laws, or breached our contractual obligations, even if we are not found liable, could be expensive and time consuming to defend, could result in adverse publicity, and could have a material adverse effect on our business, financial condition, results of operations, and prospects.

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, including in Trans Ova, 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. Although we maintain workers' compensation insurance to cover us for costs and expenses we may incur due to injuries to our employees resulting from the use of hazardous materials, this insurance may not provide adequate coverage against potential liabilities. We do not maintain insurance for environmental liability or toxic tort claims that may be asserted against us in connection with our storage or disposal of biological or hazardous materials.

We are subject to certain United States and foreign anti-corruption, anti-money laundering, export control, sanctions and other trade laws and regulations. We can face serious consequences for violations.

Among other matters, United States and foreign anti-corruption, anti-money laundering, export control, sanctions and other trade laws and regulations prohibit companies and their employees, agents, clinical research organizations, legal counsel, accountants, consultants, contractors and other partners from authorizing, promising, offering, providing, soliciting, or receiving directly or indirectly, corrupt or improper payments or anything else of value to or from recipients in the public or private sector.

Our business is heavily regulated and therefore involves significant interaction with public officials. We have direct or indirect interactions with officials and employees of government agencies or government-affiliated hospitals, universities and other organizations. We also expect our non-United States activities to increase in time. Additionally, in many other countries, the healthcare providers who prescribe pharmaceuticals are employed by their government, and the purchasers of pharmaceuticals are government entities; therefore, our dealings with these prescribers and purchasers are subject to regulation under the United States Foreign Corrupt Practices Act of 1977, as amended, or FCPA. We plan to engage third parties for clinical trials and/or to obtain necessary permits, licenses, patent registrations, and other regulatory approvals and we can be held liable for the corrupt or other illegal activities of our personnel, agents, or partners, even if we do not explicitly authorize or have prior knowledge of such activities. In particular, our operations will be subject to FCPA, which prohibits, among other things, United States companies and their employees and agents from authorizing, promising, offering, or providing, directly or indirectly, corrupt or improper payments or anything else of value to foreign government officials, employees of public international organizations and foreign government-owned or affiliated entities, candidates for foreign political office, and foreign political parties or officials thereof. Recently, the SEC and Department of Justice have increased their FCPA enforcement activities with respect to biotechnology and pharmaceutical companies. There is no certainty that all of our employees, agents, suppliers, manufacturers, contractors, or collaborators, or those of our affiliates, will comply with all applicable laws and regulations, particularly given the high level of complexity of these laws.

Violations of these laws and regulations could result in fines, criminal sanctions, including imprisonment, against us, our officers, or our employees, the closing down of facilities, including those of our suppliers and manufacturers, requirements to obtain export licenses, cessation of business activities in sanctioned countries, implementation of compliance programs, debarment, reputational harm, prohibitions on the conduct of our business, and other consequences. Any such violations could also result in prohibitions on our ability to offer our product candidates in one or more countries as well as difficulties in manufacturing or continuing to develop our product candidates, and could materially damage our reputation, our brand, our ability to attract and retain employees and our business, prospects, operating results, and financial condition.

Risks Related to our Business Operations and Strategy

We rely on third parties, including through collaborations, to develop and commercialize some of our product candidates. Markets in which our collaborators are developing product candidates using our technologies are subject to extensive regulation, and we rely on our collaborators to comply with all applicable laws and regulations.

We have entered, and may in the future enter into collaboration arrangements to develop product candidates enabled by our technologies. There can be no guarantee that we can successfully manage these relationships. If our collaborators are not able to successfully develop the product candidates enabled by our technologies, none of these enabled product candidates will become commercially available, and we will receive no back-end payments under these arrangements. Some of our existing collaborators do not themselves have the resources necessary to commercialize product candidates, and they in turn will need to rely on additional sources of financing or third-party collaborations. We may be asked to, or choose 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. In addition, we typically have limited or no control over the amount or timing of resources that any collaborator is able or willing to devote to developing product candidates or collaborative efforts. Any of our collaborators may fail to perform its obligations. Our collaborators may breach or terminate their agreements with us or otherwise fail to conduct their collaborative activities successfully and in a timely manner.

Our technologies are used in product candidates that are subject to extensive regulation by governmental authorities. We depend on our collaborators to comply with these laws and regulations with respect to product candidates they produce using our technologies, and we do not independently monitor whether our collaborators comply with applicable laws and regulations. If 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 collaborators to produce the end products enabled by our technologies for sale.

We have previously entered into, and may enter into new, strategic collaborations with third parties, which we may fail to successfully manage, or from which disputes may arise.

We have previously entered into, and may in the future enter into new, strategic collaborations to develop products enabled by our technologies. We may face significant competition in seeking appropriate partners for our product candidates, and the negotiation process may be time-consuming and complex. There can be no guarantee that we can successfully manage these relationships, as they involve complex interests and our interests and our collaborators' interests may diverge, including as we transition away from, or terminate, strategic collaborations.

In our collaboration arrangements, we depend on the performance of our collaborators. Our collaborators may fail to perform their obligations under the collaboration agreements or may not perform their obligations in a timely manner. If conflicts arise between our collaborators and us, the other party may act in a manner adverse to us and could limit our ability to implement our strategies. Furthermore, our collaborators may not properly obtain, maintain, enforce or defend our intellectual property or proprietary rights or may use our proprietary information in such a way as to invite litigation that could jeopardize or invalidate our proprietary information or expose us to potential litigation. In addition, we cannot control the amount and timing of resources our collaborators may devote to our product candidates. They may separately pursue competing products, therapeutic approaches or technologies to develop treatments for the diseases targeted by us. Competing products, either developed by the collaborators or to which the collaborators have rights, may result in the withdrawal of support for our product candidates. Even if our collaborators continue their contributions to the strategic collaborations, they may nevertheless determine not to actively pursue the development or commercialization of any resulting products. Additionally, if our collaborators pursue different clinical or regulatory strategies with their product candidates based on similar technology as used in our product candidates, adverse events with their product candidates could negatively affect our product candidates. Any of these developments could harm our product development efforts.

If our collaborators terminate or breach our agreements with them, or otherwise fail to complete their obligations in a timely manner, it may have a detrimental effect on our financial position by reducing or eliminating the potential for us to receive technology access and license fees, milestones and royalties, reimbursement of development costs, as well as possibly requiring us to devote additional efforts and incur costs associated with pursuing internal development of product candidates. Furthermore, if our collaborators do not prioritize and commit sufficient resources to our product candidates, we or our partners may be unable to develop or commercialize these product candidates, which would limit our ability to generate revenue and become profitable. In some cases, our strategic collaborations have resulted in disagreements and disputes with our current and former collaborators regarding the relative rights, obligations, and revenues of us and our collaboration partners. In addition, we remain susceptible to future additional disagreements and disputes with any of our current or future collaborators. Disagreements and disputes may result in litigation, unfavorable settlements or concessions by us, or management distraction, that could harm our business operations.

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 may be sued for product liability.

We face an inherent risk of product liability exposure related to the testing of our product candidates in human trials and may face greater risk if we commercialize any products that we develop. Product liability claims may be brought against us by subjects enrolled in our trials, patients, healthcare providers or others using, administering, or selling our products.

Additionally, each of our collaborations requires the collaborator to indemnify us for liability related to products produced pursuant to the collaboration 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. 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 collaboration. 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 or even cause us to go out of business.

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.

Our insurance policies are expensive and protect only from some business risks, which leaves us exposed to significant uninsured liabilities.

We do not carry insurance for all categories of risks that our business may encounter, and insurance coverage is becoming increasingly expensive. We do not know if we will be able to maintain existing insurance with adequate levels of coverage, and any liability insurance coverage we acquire in the future may not be sufficient to reimburse us for any expenses or losses we may suffer. If we obtain marketing approval for any product candidates that we or our collaborators may develop, we intend to acquire insurance coverage to include the sale of commercial products, but we may be unable to obtain such insurance on commercially reasonable terms or in adequate amounts. Required coverage limits for such insurances are difficult to predict and may not be sufficient. If potential losses exceed our insurance coverage, our financial condition would be adversely affected. In the event of contamination or injury, we could be held liable for damages or be penalized with fines in an amount exceeding our resources. Clinical trials or regulatory approvals for any of our product candidates could be suspended, which could adversely affect our results of operations and business, including by preventing or limiting the development and commercialization of any product candidates that we or our collaborators may develop.

The livestock products of our Exemplar reporting segment are subject to disease outbreaks that can increase the cost of production and/or reduce production harvests, and the loss of existing livestock would result in the loss of commercial technology.

Several of the products of our operating subsidiary, Exemplar, are subject to periodic outbreaks of a variety of diseases. Although Exemplar takes measures to protect their animals, there can be no assurance that a disease will not damage or destroy existing animals. The economic impact of disease to Exemplar can be significant, as we must incur the cost of preventive measures, such as vaccines and antibiotics, and then if infected, the cost of lost or reduced production.

The markets in which we are developing candidate products using our technologies are highly competitive. Competitors and potential competitors may develop products and technologies that make ours obsolete or garner greater market share than ours.

While we believe that our novel approach to developing the next generation of gene and cell therapies to target the most urgent and intractable challenges in immuno-oncology, autoimmune disorders, and infectious diseases provides us with competitive advantages, our industry is highly competitive and subject to rapid and significant technological change. Many of our competitors have significantly greater financial, technical, and human resource capabilities than we do, and certain of our competitors may also benefit from local government subsidies and other incentives that are not available to us. In addition, mergers and acquisitions in the pharmaceutical and biotechnology industries may result in even more resources being

concentrated among a smaller number of our competitors. As a result of the resources available to our competitors, 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 can. The availability of reimbursement from government and other third-party payers will also significantly affect the pricing and competitiveness of our products. Our competitors may also obtain FDA or other regulatory approval for their products more rapidly than we may obtain approval for ours, which could result in our competitors establishing a strong market position before we are able to enter the market.

Our lead product candidates include PRGN-3005 for the treatment of ovarian cancer and PRGN-3006 for the treatment of AML, which are built on our UltraCAR-T platform, and PRGN-2009, which is based on our AdenoVerse platform. While we are employing a novel approach, there are a number of competitors pursuing CAR-T cell therapies for the treatment of cancer. We believe that, among others, Bristol-Myers Squibb, Tmunity Therapeutics, and Anixa Biosciences are developing CAR-T based treatments for ovarian cancer and TCR2 Therapeutics is developing TCR-T based treatment for ovarian cancer. We believe that Celyad, Mustang Bio, Kite, Amgen, Cellectis S.A., and Allogene Therapeutics are also using CAR-T technology to develop product candidates for the treatment of AML. The CAR-T technology space also has significant other competition including from multiple companies and their collaborators, such as Novartis and University of Pennsylvania, Kite and Gilead, Adaptimmune and GSK, Autolus Therapeutics, Poseida Therapeutics, and Bellicum Pharmaceuticals. We also face competition from non-cell based cancer treatments offered by other companies such as Amgen, AstraZeneca, Incyte, Merck, Abbvie, and Roche.

In the area of infectious diseases, our lead product candidate is PRGN-2012, which is based on our AdenoVerse immunotherapy platform, for the treatment of RRP. We believe there are competitors in this area, including INOVIO Pharmaceuticals with their investigational DNA vaccine INO-3107 targeting HPV6 and HPV11 antigens.

We are also using our suite of proprietary and complementary technologies for the preclinical and clinical development of product candidates for the treatment of autoimmune disorders, including T1D. We believe that our primary competitors with respect to the development of immunotherapies for T1D are Provention Bio, Midatech Pharma, and MerciaPharma.

There are a number of companies that compete with our subsidiary Exemplar, including Surrogen and Renovate.

Our ability to compete successfully will depend on our ability to develop proprietary technologies that can be used 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. 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. To the extent that any of our competitors are more successful with respect to any key competitive factor or we 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.

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 continue to commercialize our product candidates.

Our business involves complex operations 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, Helen Sabzevari Ph.D., 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 product candidates 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 support our internal research and development programs or meet other demands.

We have had a number of executive officers depart from our Company over the last several years, and we continually evaluate our leadership structure. Our past or future leadership changes could lead to strategic and operational challenges and uncertainties, distractions of management from other key initiatives, inefficiencies or increased costs, any of which could

adversely affect our business, financial condition, results of operations, and cash flows.

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 have been and continue to 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 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, these safeguards have been vulnerable to attack. 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 certain of our information systems, we cannot ensure that the coverage is adequate to compensate for any damages that may be incurred.

The effects of health epidemics, including the COVID-19 pandemic, could adversely affect our business operations, which could have a material adverse effect on our results of operations, cash flows, and financial position.

The operations of our business could be adversely affected by health epidemics, including, for example, if we are unable to secure necessary supplies, including personal protection equipment for our employees. We also rely on third parties for various aspects of our business, including developing some of our product candidates. These third parties may experience similar disruptions or negative impacts to their businesses due to epidemics, which may result in additional delays or otherwise adversely impact our operations.

In addition to the potential impacts to our operations, we may be required to implement, or reinstitute, precautions to mitigate the spread of the illness across our businesses, which may impact our ability to carry out our business as usual, including additional sanitation and cleaning procedures in our laboratories and other facilities, instituting remote working when possible, and implementing social distancing and staggered worktime requirements for our employees that must work on-site. An increase in remote working may also result in elevated susceptibility to cyber security risks. For example, due to the COVID-19 pandemic, we have incurred additional costs as a result of these measures. These measures could also lead to reduced efficiency in our operations.

Several of our operations are leanly staffed and rely on key personnel to manage operations. The loss of our key scientific staff, personnel, or other key employees, as a result of illness or otherwise, could negatively impact our business and operations, particularly if we are unable to adequately find or train replacements.

A significant outbreak of infectious diseases in the future could result in a widespread health crisis that could adversely affect the economies and financial markets worldwide, resulting in an economic downturn that could impact our business, financial condition and results of operations.

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;
- disease outbreaks, environmental catastrophes, 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.

Additionally, 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.

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;
- the potential disruption of our ongoing business and diversion of management resources;
- adverse effects on existing business relationships with current and/or prospective collaborators, customers and/or suppliers;
- unanticipated expenses related to the acquired operations;
- risks associated with entering markets in which we have no or limited prior experience;
- 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 loss of key employees or potential inability to retain, integrate, and motivate key personnel.

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.

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.

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.

In August 2020, the FASB issued Accounting Standards Update 2020-06, *Debt—Debt with Conversion and Other Options (Subtopic 470-20) and Derivatives and Hedging—Contracts in Entity's Own Equity (Subtopic 815-40)—Accounting for Convertible Instruments and Contracts in an Entity's Own Equity*, which will require us to use the "if-converted" method when calculating diluted earnings per share for convertible instruments. As the treasury stock method will no longer be permitted beginning in our fiscal year 2022, our diluted earnings per share could be adversely affected. Additionally, we cannot be sure whether other changes may be made to the current accounting standards related to the Convertible Notes, or otherwise, that could have an adverse impact on our financial statements.

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

As of December 31, 2022, we had net operating loss carryforwards of approximately \$819.1 million for United States federal income tax purposes available to offset future taxable income, including \$604.2 million generated after 2017, United States capital loss carryforwards of \$212.5 million, and United States federal and state research and development tax credits of \$12.1 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. Net operating loss carryforwards generated prior to 2018 began to expire in 2022, and capital loss carryforwards will expire if unutilized beginning in 2024. 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, 2022, we had utilized all net operating losses subject to Section 382 limitations, other than those losses inherited via acquisitions. As of December 31, 2022, approximately \$41.4 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, 2022, our direct foreign subsidiaries included in continuing operations had foreign loss carryforwards of approximately \$71.0 million, most of which do not expire.

The proceeds received from the sale of our subsidiary, Trans Ova, together with certain additional funds, were placed in a segregated account upon the closing of the Transaction and must be used for certain permitted purposes, including resolution of our outstanding convertible bonds, and therefore we have limited discretion in the use of proceeds and the additional funds we put in.

On July 1, 2022, we entered into an agreement (the "Purchase Agreement") to sell 100% of the outstanding membership interests of Trans Ova Genetics, L.C., an Iowa limited liability company ("Trans Ova"), our wholly-owned subsidiary, to Spring Bidco LLC, a Delaware limited liability company (the "Buyer") in exchange for \$170.0 million in cash payable at the closing of the transaction (subject to a working capital adjustment mechanism) and up to \$5.0 million in cash earn-out payments contingent upon the performance of Trans Ova in each of 2022 and 2023 (the "Transaction").

In connection with the closing of the Transaction, as of December 31, 2022, we held a total of \$43.3 million, in a segregated account and will use such funds for certain permitted purposes, including resolution of our outstanding convertible bonds. Therefore, we have limited discretion in the use of proceeds in the segregated account, which may have a negative impact on our liquidity and ability to satisfy our capital requirements and we may be prevented from using the cash opportunistically for other purposes.

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 product candidates. 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 technologies and product pipeline. 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.

For instance, we pursue protection of switch technologies, gene delivery technologies, and genetic componentry related to our

pipeline products. In addition, we seek patents covering specific collaborator's products. We have also filed patents and patent applications in other jurisdictions, such as Australia, 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 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 licensors, 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, misappropriation or other violation 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, misappropriation or violation 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 biotechnology is particularly complex. We are aware of United States and foreign patents and pending patent applications of third parties that cover various aspects of cell and gene 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 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 are infringing upon patent claims even if we do not believe such claims to be valid and enforceable.

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 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 licensee 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. Even if we were able to obtain a license, it could be non-exclusive, thereby giving our competitors and other third parties access to the same technologies licensed to us, and it could require us to make substantial licensing and royalty payments. 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 us or our licensees from developing and commercializing products using our technologies, which could harm our business, financial condition, and operating results. In addition, we could be found liable for monetary damages, including treble damages and attorneys' fees, if we are found to have willfully infringed a patent or other intellectual property right.

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. In addition, there could be public announcements of the results of hearings, motions, or other interim proceedings or developments, and if securities analysts or investors perceive these results to be negative, it could have a substantial adverse effect on the price of our common stock.

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. A patent term extension cannot extend the remaining term of a patent beyond a total of 14 years from the date of product approval, only one patent may be extended, and only those claims covering the approved drug, a method for using it, or a method for manufacturing it may be extended. 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 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 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.

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

We have entered into license agreements with third parties and may need to obtain additional licenses from our existing licensors and others to advance our research or allow commercialization of product candidates we may develop. It is possible that we may be unable to obtain any additional licenses at a reasonable cost or on reasonable terms, if at all. Disputes may arise regarding intellectual property subject to a licensing agreement, including:

- the scope of rights granted under the license agreement and other interpretation-related issues;
- the extent to which our technology and processes infringe, misappropriate or otherwise violate the intellectual property of the licensor that is not subject to the licensing agreement;
- our diligence obligations under the license agreement and what activities satisfy those diligence obligations;
- the inventorship and ownership of inventions and know-how resulting from the joint creation or use of intellectual property by our licensors and us and our partners; and
- the priority of invention of patented technology.

In addition, the agreements under which we currently license intellectual property or technology from third parties are complex, and certain provisions in such agreements may be susceptible to multiple interpretations. The resolution of any contract interpretation disagreement that may arise could narrow what we believe to be the scope of our rights to the relevant intellectual property or technology, or increase what we believe to be our financial or other obligations under the relevant agreement. Moreover, if disputes over intellectual property that we have licensed prevent or impair our ability to maintain our current licensing arrangements on commercially acceptable terms, we may be unable to successfully develop and commercialize the affected product candidates.

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. We cannot guarantee that we have entered into such agreements with each party that may have or have had access to our trade secrets or proprietary technology and processes. Despite these efforts, any of these parties may breach the agreements and disclose our proprietary information, including our trade secrets, and we may not be able to obtain adequate remedies for such breaches. 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.

Risks Related to our Common Stock

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 outcomes of our research programs, clinical trials, or other product development and approval processes;
- our ability to develop and successfully commercialize our products;
- the timing, receipt, and amount of any payments received in connection with upfront, milestone, and sale and royalty payments, if any;
- our ability to successfully scale up production of our commercial products and customer acceptance thereof;
- our ability to enter into strategic transactions;
- our ability to develop and maintain our technologies;
- our ability to manage our growth;
- risks associated with the international aspects of 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;
- 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;
- potential advantages that our competitors 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;
- business interruptions such as power outages and other natural disasters;
- our ability to integrate any businesses or technologies we may acquire with our business;
- negative public opinion and increased regulatory scrutiny of gene and cell therapies;
- 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
- 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.

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, 2021 through February 15, 2023, our common stock has traded as high as \$2.90 per share and as low as \$1.12 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, divestitures, 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.

In addition, we believe there has been and may continue to be substantial off-market transactions in derivatives of our stock, including short selling activity or related similar activities, which are beyond our control and which may be beyond the full control of the SEC and Financial Institutions Regulatory Authority, or FINRA. While SEC and FINRA rules prohibit some forms of short selling and other activities that may result in stock price manipulation, such activity may nonetheless occur without detection or enforcement. Significant short selling or other types of market manipulation could cause our stock trading price to decline, to become more volatile, or both.

Additionally, we have historically, and may from time to time in the future, own equity interests in our collaborators. Owning equity in our collaborators increases our exposure to the risks of our collaborators' businesses beyond the products of those collaborations. Any 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. If our equity position is a minority position, we are exposed to further risk as we will not be able to exert control over the companies in which we hold securities.

If we do not meet the continued listing requirements of Nasdaq our common stock may be delisted.

Our common stock is listed on Nasdaq Global Select Market ("Nasdaq"). Nasdaq requires us to continue to meet certain listing standards, including standards related to the trading price of our common stock. While we are currently in compliance with the NYSE continued listing requirements, we cannot assure you that we will remain in compliance. If we do not meet Nasdaq's continued listing standards, we will be notified by Nasdaq and we will be required to take corrective action to meet the continued listing standards; otherwise our common stock will be delisted from Nasdaq. A delisting of our common stock on Nasdaq would reduce the liquidity and market price of our common stock and the number of investors willing to hold or acquire our common stock, which could negatively impact our ability to access the public capital markets. A delisting would also reduce the value of our equity compensation plans, which could negatively impact our ability to retain key employees.

We do not anticipate paying cash dividends, and accordingly, shareholders will have to rely on any 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 twice distributed equity securities of affiliated entities to our shareholders as a special stock dividend, most recently in 2017, but 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.

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 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 impact 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 impacted and our common stock price could decrease, possibly significantly.

As of December 31, 2022, Randal J. Kirk controlled approximately 41 percent of our common stock. 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.

We have historically been controlled, managed, and principally funded by Randal J. Kirk, our Executive Chairman, and affiliates of Mr. Kirk, including Third Security. As of February 15, 2023, Mr. Kirk and shareholders affiliated with him beneficially owned approximately 38 percent of our voting stock, and our executive officers and directors, as a group, owned approximately 40 percent of our voting common stock. Mr. Kirk may be 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, and he may be able to exert significant influence on other corporate actions as a result of his role as our Executive Chairman and status as a significant shareholder. Further, our executive officers and directors, acting together as shareholders, 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 Executive Chairman, and his affiliates have an interest.

We have engaged in a variety of transactions, including collaborations and our sale of our non-healthcare assets to TS Biotechnology, 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 1, 3, 4, 5, 13, 14, and 17" appearing elsewhere in this Annual Report for a discussion of such transactions. Mr. Kirk serves as the Senior Managing Director and Chairman of Third Security and owns 100 percent of the equity interests of Third Security. We believe that each 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. Furthermore, as we execute on these transactions going forward, a conflict may arise between our interests and those of Mr. Kirk and his affiliates.

Sales of a substantial number of shares of our common stock in the public market could occur at any time. 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, 2022, there were 15,201,276 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, 2022, there were 697,815 Restricted Stock Units, or 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, 2022, we had 12,949,460 of shares available for grant under the 2013 Omnibus Incentive Plan and 7,243,025 shares available for grant under the 2019 Incentive Plan for Non-Employee Service Providers.

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. Effective February 1, 2020, the Series A Preferred Stock designations was terminated. In the future, we may enter into similar facilities or issue preferred stock that has greater rights, preferences, and privileges than our common stock.

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;
- 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;
- provide for the inability of shareholders to convene a shareholders' meeting without the support of shareholders owning together 25 percent of our common stock;
- provide for 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.

Item 1B. Unresolved Staff Comments

Not applicable.

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 used in our healthcare operations as of December 31, 2022:

Location	Square Footage
Germantown, Maryland (Biopharmaceuticals segment)	61,048
Ghent, Belgium (Biopharmaceuticals segment)	14,198

Our primary domestic production and lab facilities, for our Exemplar segment, are located in Flandreau, South Dakota, and Johnson County, Iowa, and include approximately 107,000 square feet of production, lab, and office facilities.

Our primary administrative offices are in Germantown, Maryland. 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 the course of our business, we are involved in litigation and legal matters, including governmental investigations. 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. As of December 31, 2022, 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.

See "Notes to the Consolidated Financial Statements - Note 16" appearing elsewhere in this Annual Report for further discussion of ongoing legal matters.

Item 4. Mine Safety Disclosures

Not applicable.

PART II

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

Market Information and Holders of Record

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

As of February 15, 2023, we had 322 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

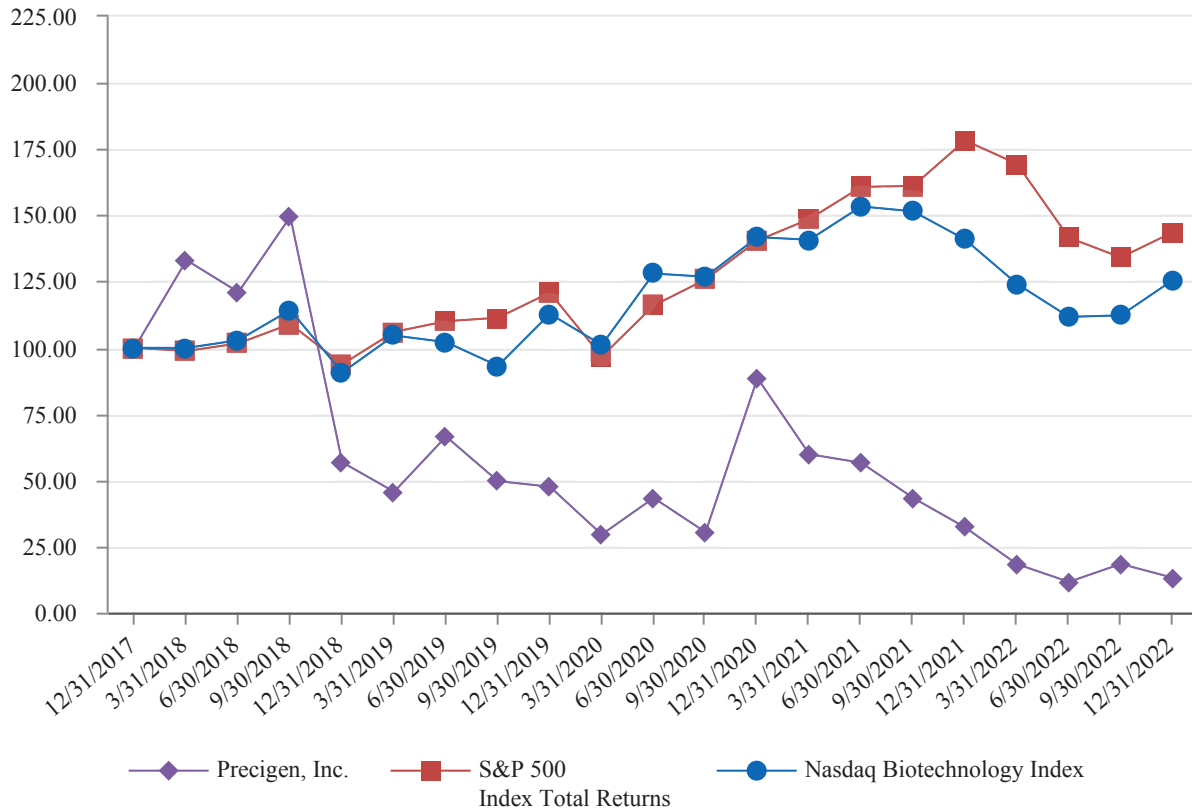
Information about our equity compensation plans is incorporated herein by reference to [Item 12 of Part III](#) of this Annual Report.

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 Precigen, Inc. under the Securities Act of 1933, as amended, or the Exchange Act.

The following graph shows a comparison from December 31, 2017 through December 31, 2022 of the cumulative total return for our common stock; the Standard & Poor's 500 Stock Index, or the S&P 500 Index; and the Nasdaq Biotechnology Index. The graph assumes that \$100 was invested at the market close on December 31, 2017 in the common stock of Precigen, Inc., the S&P 500 Index, and the Nasdaq Biotechnology Index, and data for the S&P 500 Index and the Nasdaq Biotechnology Index assumes reinvestments of dividends. The stock price performance of the following graph is not necessarily indicative of future stock price performance.

**Comparison of 60 Month Cumulative Total Return
Assumes Initial Investments of \$100
December 2021**



Company / Index	Base Period				
	12/31/2017	3/31/2018	6/30/2018	9/30/2018	12/31/2018
Precigen, Inc.	\$ 100.00	\$ 133.07	\$ 121.01	\$ 149.48	\$ 56.77
S&P 500 Index	100.00	98.78	101.67	108.99	93.76
Nasdaq Biotechnology Index	100.00	99.93	102.88	114.27	90.68

Company / Index	3/31/2019	6/30/2019	9/30/2019	12/31/2019	3/31/2020	6/30/2020	9/30/2020	12/31/2020
Precigen, Inc.	\$ 45.66	\$ 66.49	\$ 49.65	\$ 47.57	\$ 29.51	\$ 43.32	\$ 30.38	\$ 88.54
S&P 500 Index	106.01	110.03	111.34	120.84	96.67	115.96	125.78	140.49
Nasdaq Biotechnology Index	104.64	102.13	93.18	112.81	101.06	128.03	126.82	141.78

Company / Index	3/31/2021	6/30/2021	9/30/2021	12/31/2021	3/31/2022	6/30/2022	9/30/2022	12/31/2022
Precigen, Inc.	\$ 59.81	\$ 56.60	\$ 43.32	\$ 32.20	\$ 18.32	\$ 11.63	\$ 18.40	\$ 13.19
S&P 500 Index	148.60	160.74	161.11	178.27	169.45	141.58	134.11	143.61
Nasdaq Biotechnology Index	140.77	153.37	151.50	140.88	124.12	111.68	112.24	125.52

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

(a) Sales of Unregistered Securities

None.

(b) Use of Proceeds

None.

(c) Issuer Repurchases of Equity Securities

None.

Item 6. [Reserved]

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." Refer to Item 7: Management's Discussion and Analysis of Financial Condition and Results of Operations in our 2021 Annual Report on Form 10-K for management's discussion and analysis of financial condition and results of operations for the fiscal year 2021 compared to fiscal year 2020.

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. Our historical collaboration and licensing revenues were generated under a business model from which we have transitioned, and we do not expect to expend significant resources servicing our historical collaborations in the future. We may enter into strategic transactions for individual platforms or programs in the future from which we may generate new collaboration and licensing revenues. We continue to generate product and service revenues through our Exemplar subsidiary, and for each of the years in the period ended December 31, 2022 and 2021, Exemplar generated positive Segment Adjusted EBITDA. Products currently in our clinical pipeline will require regulatory approval and/or commercial scale-up before they may commence significant product sales and operating profits.

As we continue our efforts to focus our business and generate additional capital, we may be willing to enter into transactions involving one or more of our operating segments and reporting units for which we have goodwill and intangible assets. These efforts could result in us identifying impairment indicators or recording impairment charges in future periods. In addition, market changes and changes in judgments, assumptions, and estimates that we have made in assessing the fair value of goodwill could cause us to consider some portion or all of certain assets to become impaired.

Sources of revenue

Although we have generated revenue in the past from collaboration agreements, our primary current revenues arise from Exemplar, which generates product and service revenues through the development and sale of genetically engineered miniature swine models. We recognize revenue when control of the promised product or service is transferred to the customer.

As we have shifted our focus to our healthcare business, we have and may continue to mutually terminate historical collaboration agreements or 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 operating expense, depending on the circumstances. See "Notes to the Consolidated Financial Statements - Note 5" appearing elsewhere in this Annual Report for a discussion of changes to our significant collaborations.

In future periods, in connection with our focus on healthcare, our revenues will primarily depend on our ability to advance and create our own programs and the extent to which we bring products enabled by our technologies to market. Other than for collaboration revenues recognized upon cancellation or modification of an existing collaboration or for revenues generated pursuant to future strategic transactions for any of our existing platforms or programs, we expect our collaboration revenues will continue to decrease in the near term, although if any new collaboration agreements or strategic transactions are entered into, revenue could be positively impacted. Our revenues will also depend upon our ability to maintain or improve the volume and pricing of Exemplar's current product and service offerings and to develop and scale up production of new offerings from the various technologies of our subsidiaries. As we focus on our healthcare business, we anticipate that our expenses will increase substantially if, and as, we continue to advance the preclinical and clinical development of our existing product candidates and our research programs. We expect a significant period of time could pass before commercialization of our various product candidates or before the achievement of contractual milestones and the realization of royalties on product candidates commercialized under our collaborations. Accordingly, there can be no assurance as to the timing, magnitude, and predictability of revenues, if any, to which we might be entitled.

Cost of products and services

Cost of products and services, all which are related to our Exemplar reporting segment, includes primarily labor and related costs, drugs and supplies, 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 and acquiring, developing, and manufacturing preclinical study and clinical trial materials;
- costs related to certain in-licensed technology rights or reacquired in-process research and development;
- amortization of patents and related technologies acquired in mergers and acquisitions; and
- facility-related expenses, which include direct depreciation costs and unallocated expenses for rent and maintenance of facilities and other operating costs.

Our research and development expenses are generally incurred by our two reportable segments and primarily relate to either costs incurred to expand or otherwise improve our technologies or the costs incurred to develop our own products and services. Our Biopharmaceuticals segment is progressing preclinical and clinical programs that target urgent and intractable diseases in our core therapeutics areas of immuno-oncology, autoimmune disorders and infectious diseases, including PRGN-3005, PRGN-3006, PRGN-3007, PRGN-2009, PRGN-2012, and AG019. Our Exemplar Segment’s research and development activities relate to new and improved pig research models. The following table summarizes our research and development expenses incurred by reportable segment and reconciles those expenses to research and development expenses on the consolidated statements of operations for the years ended December 31, 2022, 2021, and 2020.

	Year Ended December 31,		
	2022	2021	2020
	(In thousands)		
Biopharmaceuticals	\$ 46,850	\$ 47,644	\$ 38,992
Exemplar	320	289	611
Total research and development expenses from reportable segments	47,170	47,933	39,603
Other research and development expenses, including from other operating segments	—	—	(171)
Eliminations	—	—	(4)
Total consolidated research and development expenses	<u>\$ 47,170</u>	<u>\$ 47,933</u>	<u>\$ 39,428</u>

The amount of research and development expenses may be impacted by, among other things, the number and nature of our own proprietary programs, and the number and size of programs we may support on behalf of collaboration agreements. We expect that our research and development expenses will increase as we continue to develop our own proprietary programs, including progression of these programs into preclinical and clinical stages. We believe these increases will likely include 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 in-licensing of technologies or 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, information technology, legal, and corporate communications functions. Other significant SG&A expenses include rent and utilities, insurance, accounting, and legal services (including the cost of settling any claims and lawsuits), and expenses associated with obtaining and maintaining our intellectual property.

SG&A expenses may fluctuate in the future depending on the scaling of our corporate functions required to support our corporate initiatives and the outcomes of legal claims and assessments against us.

Other income (expense), net

Interest income consists of interest earned on our cash and cash equivalents and short-term and long-term investments and may fluctuate based on amounts invested and current interest rates.

Interest expense consists primarily of interest on our Convertible Notes, which decreased in 2022 due to both the adoption of a new accounting standard effective January 1, 2022, which simplified the accounting for the Convertible Notes, and the redemption of a portion of our Convertible Notes. See "Notes to the Condensed Consolidated Financial Statements - Note 2" appearing elsewhere in this Annual Report for further discussion regarding the adoption of the new accounting standard. In the second half of 2022, we retired Convertible Notes with principal amounts of \$156.7 million. The net gain recorded on extinguishment of 1.0 million is included in Other income (expense), net. See "Notes to the Condensed Consolidated Financial Statements - Note 11" appearing elsewhere in this Annual Report for further discussion. The extinguishment of these Convertible Notes will alleviate us of \$4.0 million in future cash interest payments had we held the Convertible Notes until maturity. We expect interest expense to be significantly lower in the first half of 2023 and diminish to zero after anticipated retirement of all remaining Convertible Notes on or before July 1, 2023.

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 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.

Segment performance

We use Segment Adjusted EBITDA as our primary measure of segment performance. We define Segment Adjusted EBITDA as net income (loss) before (i) interest expense, (ii) income tax expense or benefit, (iii) depreciation and amortization, (iv) stock-based compensation expense, (v) loss on settlement agreements where noncash consideration is paid, (vi) adjustments for accrued bonuses paid in equity awards, (vii) gain or loss on disposals of assets, (viii) loss on impairment of goodwill and other noncurrent assets, (ix) equity in net loss of affiliates, and (x) recognition of previously deferred revenue associated with upfront and milestone payments as well as cash outflows from capital expenditures and investments in affiliates, but includes proceeds from the sale of assets in the period sold. Corporate expenses are not allocated to the segments and are managed at a consolidated level. See "Notes to the Consolidated Financial Statements - Note 18" appearing elsewhere in this Annual Report for further discussion of Segment Adjusted EBITDA.

Results of operations

Comparison of the year ended December 31, 2022 to the year ended December 31, 2021

The following table summarizes our results of operations for the years ended December 31, 2022 and 2021, together with the changes in those items in dollars and as a percentage:

	Year Ended December 31,		Dollar Change	Percent Change
	2022	2021		
	(In thousands)			
Revenues				
Collaboration and licensing revenues	\$ 14,661	\$ 506	\$ 14,155	>2000%
Product revenues	1,903	2,164	(261)	(12.1)%
Service revenues	10,094	11,095	(1,001)	(9.0)%
Other revenues	251	502	(251)	(50.0)%
Total revenues	26,909	14,267	12,642	88.6 %
Operating expenses				
Cost of products and services	6,339	5,745	594	10.3 %
Research and development	47,170	47,933	(763)	(1.6)%
Selling, general and administrative	48,006	51,994	(3,988)	(7.7)%
Impairment of goodwill	482	—	482	N/A
Impairment of other noncurrent assets	638	543	95	17.5 %
Total operating expenses	102,635	106,215	(3,580)	(3.4)%
Operating loss	(75,726)	(91,948)	16,222	(17.6)%
Total other expense, net	(5,102)	(19,016)	13,914	(73.2)%
Equity in loss of affiliates	862	(3)	865	>200%
Loss from continuing operations before income taxes	(79,966)	(110,967)	31,001	(27.9)%
Income tax benefit	189	160	29	18.1 %
Loss from continuing operations	(79,777)	(110,807)	31,030	(28.0)%
Income from discontinued operations, net of income tax benefit (1)	108,094	18,641	89,453	>200%
Net loss attributable to Precigen	\$ 28,317	\$ (92,166)	\$ 120,483	130.7 %

(1) See "Notes to the Consolidated Financial Statements - Note 3" appearing elsewhere in this Annual Report.

Collaboration and licensing revenues

The following table shows the collaboration and licensing revenue recognized for the years ended December 31, 2022 and 2021, together with the changes in those items.

	Year Ended December 31,		Dollar Change
	2022	2021	
	(In thousands)		
Alaunos Therapeutics, Inc. (formerly ZIOPHARM Oncology, Inc.)	\$ 100	\$ 100	\$ —
Intrexon Energy Partners, LLC	3,768	—	3,768
Intrexon Energy Partners II, LLC	10,793	—	10,793
Castle Creek Biosciences, Inc.	—	388	(388)
Other	—	18	(18)
Total	<u>\$ 14,661</u>	<u>\$ 506</u>	<u>\$ 14,155</u>

Collaboration and licensing revenues increased \$14.2 million from the year ended December 31, 2021, primarily due to the fact we obtained control of Intrexon Energy Partners and Intrexon Energy Partners II and ultimately dissolved in 2022 therefore we recognized the remaining balance of deferred revenue associated with Intrexon Energy Partners and Intrexon Energy Partners II, less the amounts paid to acquire the membership interests of the investors.

Product and services revenues, and gross margin

Product revenues decreased \$(0.3) million, or (12) percent, over the year ended December 31, 2021. The decrease in product revenues was primarily due to product mix and lower customer demand at Exemplar. Service revenues decreased \$(1.0) million, or (9) percent, over the year ended December 31, 2021. The decrease in service revenues was primarily the result of lower demand from existing customers. Gross margin on products and services declined in the current period as a result of the decreased revenues and an increase in salaries, benefits, and other personnel costs at Exemplar.

Research and development expenses

Research and development expenses decreased \$(0.8) million, or (1.6) percent, over the year ended December 31, 2021. Salaries, benefits, and other personnel costs increased \$1.8 million due to an increase in the hiring of employees to support the growth in the Company's development activities as well as increases in salaries of our continuing employees. These increases were offset by a decrease in contract research organization costs and lab supplies of \$2.4 million, primarily due to timing differences, the completion of our 1b/2a clinical trial of AG019 in the fourth quarter of 2021, and as well as a continued prioritization of clinical product candidates with less expense incurred related preclinical research programs compared to 2021.

Selling, general and administrative expenses

SG&A expenses decreased \$(4.0) million, or (8) percent, from the year ended December 31, 2021. Salaries, benefits, and other personnel costs decreased \$4.9 million in 2022 primarily due to (i) a reduced headcount as we scaled down our corporate functions to support our more streamlined organization and (ii) reduced stock compensation costs. This increase was partially offset by an increase of \$0.9 million in legal and professional fees, primarily related to ongoing litigation.

Total other expense, net

Total other expense, net, which primarily includes interest expense related to our Convertible Notes issued July 2018, decreased \$13.9 million, or (73) percent. The current period decrease is primarily due to the adoption of a new accounting standard effective January 1, 2022 noted above, which simplified the accounting for the Convertible Notes and reduced non-cash interest expense, as well as a \$1.0 million gain in connection with the early retirement of a portion of our Convertible Notes.

Segment performance

The following table summarizes Segment Adjusted EBITDA, which is our primary measure of segment performance, for the years ended December 31, 2022 and 2021, for each of our reportable segments, as well as unallocated corporate costs.

	Year Ended December 31,		Dollar Change	Percent Change
	2022	2021		
(In thousands)				
Segment Adjusted EBITDA:				
Biopharmaceuticals	\$ (45,039)	\$ (45,754)	\$ 715	1.6 %
Exemplar	4,997	6,898	(1,901)	(27.6)%
Unallocated corporate costs	(32,913)	(33,506)	593	1.8 %

For a reconciliation of Segment Adjusted EBITDA to net loss from continuing operations before income taxes, see "Notes to the Consolidated Financial Statements - Note 18" appearing elsewhere in this Annual Report.

The following table summarizes revenues from external customers for the years ended December 31, 2022 and 2021, for each of our reportable segments.

	Year Ended December 31,		Dollar Change	Percent Change
	2022	2021		
(In thousands)				
Biopharmaceuticals	\$ 14,894	\$ 922	\$ 13,972	>200%
Exemplar	12,015	13,345	(1,330)	(10.0)%

Biopharmaceuticals

The increase in revenues for Biopharmaceuticals was primarily due to the fact that we obtained control of Intrexon Energy Partners and Intrexon Energy Partners II in the third quarter of 2022 and therefore we recognized the remaining balance of deferred revenue associated with Intrexon Energy Partners and Intrexon Energy Partners II, less the amounts paid to acquire the membership interests of the investors. See Note 5 for further detail. Segment adjusted EBITDA is in line with previous year.

Exemplar

Revenues for Exemplar decreased due to a reduction in services performed with existing customers. The deterioration in Segment Adjusted EBITDA was primarily due to the reduction in revenues and increase in personnel costs.

Unallocated Corporate Costs

Unallocated corporate costs are in line with previous year. The reduction in personnel expenses was offset by higher legal and professional services.

Liquidity and capital resources

Sources of liquidity

We have incurred losses from operations since our inception, and as of December 31, 2022, we had an accumulated deficit of \$1.9 billion. From our inception through December 31, 2022, 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, and sales of non-core businesses. As of December 31, 2022, we had cash and cash equivalents of \$4.9 million and short-term and long-term investments of \$51.1 million. We also had restricted cash (short term) of \$43.3 million at December 31, 2022. This cash is restricted for the permitted purposes related to our Convertible Notes, including the resolution of such notes. 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.

In addition, in January 2023, we closed a public offering of 43,962,640 shares of our common stock, resulting in net proceeds to us of approximately \$73.0 million, after deducting underwriting discounts, fees, and other underwriting expenses.

At-the-Market Sales Agreement

As disclosed in "Notes to the Consolidated Financial Statements - Note 13" appearing elsewhere in this Annual Report, on August 9, 2022, we entered into a Controlled Equity Offering Sales Agreement with Cantor Fitzgerald & Co. (the "Sales Agreement"), pursuant to which we may issue and sell from time to time shares of our common stock of up to \$100 million. We have no obligation to sell any of the Shares under the Sales Agreement, and may at any time suspend or terminate the offering of our common stock pursuant to the Sales Agreement upon notice and subject to other conditions. We intend to use the proceeds of any sales under the Sales Agreement, if any sales are made, to fund the development of clinical and preclinical product candidates and for working capital and other general corporate purposes.

Capital Resources

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

	Year Ended December 31,		
	2022	2021	2020
	(In thousands)		
Net cash provided by (used in):			
Operating activities	\$ (65,045)	\$ (55,771)	\$ (77,021)
Investing activities	226,417	(74,540)	27,779
Financing activities	(155,292)	121,187	32,705
Effect of exchange rate changes on cash, cash equivalents, and restricted cash	(827)	217	353
Net increase (decrease) in cash, cash equivalents, and restricted cash	<u>\$ 5,253</u>	<u>\$ (8,907)</u>	<u>\$ (16,184)</u>

Cash flows from operating activities:

In 2022, our net income was \$28.3 million, which includes a gain on sale of discontinued operations of \$94.7 million which is presented as an adjustment to net income to net cash used in operating activities. Additional adjustments to reconcile net income to net cash used in operating activities netted to approximately \$24.0 million, from both continuing and discontinued operations, with the most significant adjustments including: (i) \$10.2 million of stock-based compensation expense, (ii) \$10.8 million of depreciation and amortization expense, and (iii) \$1.0 million accretion of debt discount and amortization of deferred financing costs. In addition, changes in operating assets and liabilities reduced net income by \$22.7 million, which the most significant change being a reduction in deferred revenue of \$23.4 million.

In 2021, our net loss was \$92.2 million, which includes the following significant noncash expenses totaling \$39.4 million from both continuing and discontinued operations: (i) \$13.9 million of stock-based compensation expense, (ii) \$13.8 million of depreciation and amortization expense, and (iii) \$11.7 million accretion of debt discount and amortization of deferred financing costs. These expenses were partially offset by a \$4.6 million noncash gain recognized upon the termination of our MBP Titan facility lease in January 2021.

In 2020, our net loss was \$170.5 million, which includes the following significant noncash expenses totaling \$107.9 million from both continuing and discontinued operations: (i) \$27.0 million of accumulated foreign currency translation losses that were realized upon the closing of the Transactions, (ii) \$23.0 million of impairment losses related to goodwill and long-lived assets, (iii) \$18.4 million of stock-based compensation expense, (iv) \$17.5 million of depreciation and amortization expense, (v) \$11.4 million loss on settlement agreement with Harvest Intrexon Enterprise Fund I, LP ("Harvest"), and (vi) \$10.6 million accretion of debt discount and amortization of deferred financing costs. These expenses were partially offset by the recognition of \$12.8 million of previously deferred revenue upon the mutual terminations of collaboration agreements with Castle Creek and Orogenics in 2020.

Our 2022 cash outflows used in operations increased \$9.3 million from the year ended December 31, 2021 primarily due to decreased cash flow from operations provided by Trans Ova (which was sold in August 2022) and Exemplar.

Our 2021 cash outflows from operations decreased \$21.3 million from the year ended December 31, 2020 primarily due to (i) increased cash inflows provided by Trans Ova and Exemplar due to increased revenues and gross margins thereon, (ii) the

reduction in cash requirements for MBP Titan as we suspended those operations in the second quarter of 2020, and (iii) reductions in operating expenses for our corporate operations as we streamlined operations in order to further prioritize the use of our capital.

Cash flows from investing activities:

During 2022, we received \$68.4 million proceeds during the year from the maturities and sales of investments and \$162.3 million from the sale of Trans Ova.

During 2021, we purchased \$174.2 million of investments, primarily using the \$121.0 million of proceeds received from the underwritten public offering discussed below. We also reinvested a portion of the \$100.2 million proceeds we received during the year from the maturities and sales of investments.

During 2020, we purchased \$171.4 million of investments, primarily using the \$64.2 million of proceeds received from the Transactions, net of cash sold, and the private placement discussed below. We also reinvested a portion of the \$133.0 million proceeds we received during the year from the maturities of investments.

Cash flows from financing activities:

During 2022, we repurchased Convertible Notes for \$154.7 million. Additionally, in January and February 2023, we made additional repurchases of Convertible Notes of \$15.5 million.

During 2021, we received \$121.0 million proceeds from the sale of our common stock in an underwritten public offering

During 2020, we received \$35.0 million proceeds from the sale of our common stock in a private placement to TS Biotechnology.

Future capital requirements

We believe our existing liquid assets will enable us to fund our operating expenses and capital requirements for at least the next 12 months. Our future capital requirements will depend on many factors, including:

- progress in our research and development programs, as well as the magnitude and speed of development of these programs;
- any delays or potential delays to our clinical trials as a result of the COVID-19 pandemic;
- the timing of regulatory approval of our product candidates and those of our collaborations;
- 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 product candidates;
- the timing and capital requirements to scale up our various product candidates and service offerings and customer acceptance thereof;
- our ability to maintain and establish additional collaborative arrangements and/or new strategic initiatives;
- the resources, time, and cost required for the preparation, filing, prosecution, maintenance, and enforcement of our intellectual property portfolio;
- strategic mergers and acquisitions, if any, including both the upfront acquisition cost as well as the cost to integrate, maintain, and expand the strategic target;
- 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; and

- the effects, duration, and severity of the ongoing COVID-19 pandemic and the actions we have taken or may take in response, any of which could significantly impact our business, operations, and financial results.

Until such time, if ever, as we can regularly generate positive operating cash flows, we plan to finance our cash needs through a combination of equity offerings, debt financings, government, or other third-party funding, strategic alliances, sales of assets, and licensing arrangements. As the COVID-19 pandemic continues to impact the economy, our future access to capital on favorable terms may be materially impacted. We may not be able to raise sufficient additional funds on terms that are favorable to us, if at all. 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. Our current stock price may make it more difficult to pursue equity financings and lead to substantial dilution if the price of our common stock does not increase. 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.

We are subject to a number of risks similar to those of other companies conducting high-risk, early-stage research and development of product candidates. Principal among these risks are dependence on key individuals and intellectual property, competition from other products and companies, and the technical risks associated with the successful research, development, and clinical manufacturing of its product candidates. Our success is dependent upon our ability to continue to raise additional capital in order to fund ongoing research and development, adequately satisfy or renegotiate long-term debt obligations, obtain regulatory approval of our products, successfully commercialize our products, generate revenue, meet our obligations, and, ultimately, attain profitable operations.

See the section entitled "Risk Factors" for additional risks associated with our substantial capital requirements.

Contractual obligations and commitments

The following table summarizes our significant contractual obligations and commitments from continuing operations as of December 31, 2022 and the effects such obligations are expected to have on our liquidity and cash flows in future periods:

	<u>Total</u>	<u>Less Than 1 Year</u>	<u>1-3 Years</u>	<u>3-5 Years</u>	<u>More Than 5 Years</u>
	(In thousands)				
Operating leases	\$ 11,669	\$ 1,599	\$ 3,769	\$ 2,885	\$ 3,416
Convertible debt (1)	43,340	43,340	—	—	—
Cash interest payable on convertible debt	1,517	1,517	—	—	—
Long-term debt, excluding convertible debt	—	—	—	—	—
Total	\$ 56,526	\$ 46,456	\$ 3,769	\$ 2,885	\$ 3,416

- (1) See "Notes to the Consolidated Financial Statements - Note 11" appearing elsewhere in this Annual Report for further discussion of our convertible debt.

In addition to the obligations in the table above, as of December 31, 2022 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, 2022, we also had research and development commitments with third parties totaling \$19.9 million that had not yet been incurred.

Net operating losses

As of December 31, 2022, we had net operating loss carryforwards of approximately \$819.1 million for United States federal income tax purposes available to offset future taxable income, including \$604.2 million generated after 2017, United States capital loss carryforwards of \$212.5 million, and United States federal and state research and development tax credits of

approximately \$12.1 million, prior to consideration of annual limitations that may be imposed under Section 382. Net operating loss carryforwards generated prior to 2018 begin to expire in 2022, and capital loss carryforwards will expire if unutilized beginning in 2024. Our foreign subsidiaries included in continuing operations have foreign loss carryforwards of approximately \$71.0 million, most of which do not expire. Excluding certain deferred tax liabilities totaling \$2.3 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 our common 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, 2022, Precigen has utilized all net operating losses subject to Section 382 limitations, other than those losses inherited via acquisitions. As of December 31, 2022, approximately \$41.4 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.

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 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

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 have historically generated collaboration and licensing revenues through 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. Options to acquire additional services are considered to determine if they constitute material rights. 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 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 as revenue.

We recognized \$14.7 million, \$0.5 million, and \$21.2 million of collaboration and licensing revenues in the years ended December 31, 2022, 2021, and 2020, respectively. As of December 31, 2022 and 2021, we have \$1.8 million and \$23.0 million, respectively, of deferred revenue related to our receipt of upfront and milestone payments.

Product and service revenues

Our product and service revenues are generated primarily through Exemplar, it generates product and service revenues through the development and sale of genetically engineered miniature swine models. We evaluate each promised product or service under our contracts and identify performance obligations for each distinct product or services. We then allocate the transaction price of the contract to each performance obligation, recognizing the transaction price as revenue at a point in time when control of the promised product is transferred to the customer or over time when the promised service is rendered. We typically recognize revenue using an out-based measure, generally time elapsed or days of service, to measure progress and transfer of the control of the performance obligation to the customer. Payment terms are typically due within 30 days of invoicing, which occurs prior to or when revenue is recognized. We recognized \$12.0 million, \$13.3 million, and \$10.1 million of product and service revenues for the years ended December 31, 2022, 2021, and 2020, respectively.

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 at December 31, or more frequently if events or circumstances between annual tests indicate that the assets may be impaired. We perform 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 quantitative goodwill impairment test. If this is the case, the quantitative goodwill impairment test is required. If the quantitative goodwill impairment test is required or elected to be performed, first, the fair value of the reporting unit is compared with its carrying amount (including goodwill). Impairment losses on goodwill are recognized based solely on a comparison of their fair value to carrying value, without consideration of any recoverability test.

When we perform quantitative evaluations, the fair value of the reporting units are primarily determined based on the income approach. The income approach is a valuation technique in which fair value is based on forecasted future cash flows, discounted at the appropriate rate of return commensurate with the risk as well as current rates of return for equity and debt capital as of the valuation date. The forecast used in our estimation of fair value was developed by management based on historical operating results, incorporating adjustments to reflect management's planned changes in operations and market considerations.

During the years ended December 31, 2022 and 2021, we recorded \$1.1 million and \$0.5 million, respectively, of impairment charges from continuing operations to write down the values of goodwill and other long-lived assets. See additional discussion regarding these impairments in "Notes to the Consolidated Financial Statements - Note 9" appearing elsewhere in this Annual Report.

Research and Development Expense, Including Clinical Trial Accruals/Expenses

We consider that regulatory requirements inherent in the research and development of new products preclude us from capitalizing such costs. Research and development costs consist of salaries and related costs of research and development personnel, including stock-based compensation expense, costs to acquire technology rights, contract research organizations and consultants, facilities, materials and supplies associated with research and development projects as well as various laboratory studies.

Clinical trial expenses are a significant component of research and development expense, and we outsource a significant portion of these costs to third parties. Third party clinical trial expenses include investigator fees, site and patient costs, CRO costs, costs for central laboratory testing, and data management costs. The accrual for site and patient costs includes inputs such as estimates of patient enrollment, patient cycles incurred, clinical site activations, and other pass-through costs. These inputs are required to be estimated due to a lag in receiving the actual clinical information from third parties. Payments for these activities are based on the terms of the individual arrangements, which may differ from the pattern of costs incurred, and are reflected on the consolidated balance sheets as a prepaid expenses and other or other accrued liabilities. These third party agreements are generally cancellable, and related costs are recorded as research and development expense as incurred. Non-refundable advance clinical payments for goods or services that will be used or rendered for future research and development activities are recorded as a prepaid asset and recognized as expense as the related goods are delivered or the related services are performed. When evaluating the adequacy of the accrued expenses, we analyze progress of the studies, including the phase or completion of

events, invoices received and contracted costs. Significant judgments and estimates may be made in determining the accrued balances at the end of any reporting period. Actual results could differ from the estimates made. The historical clinical accrual estimates have not been materially different from the actual costs.

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 section provides quantitative information on our exposure to interest rate 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 and long-term investments of \$56.0 million and \$157.2 million as of December 31, 2022 and 2021, respectively. Our cash and cash equivalents and short-term and long-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.

Item 8. Financial Statements and Supplementary Data

The information required by this Item 8 is contained on pages F-1 through F-53 of this Annual Report.

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

None.

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, 2022. The term "disclosure controls and procedures," as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act means controls and other procedures of a company that are designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the SEC's rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is accumulated and communicated to the company's management, including its principal executive and principal financial officers, as appropriate to allow timely decisions regarding required disclosure. Management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Based on their evaluation of our disclosure controls and procedures as of December 31, 2022, 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, 2022. 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, 2022.

Deloitte & Touche LLP, an independent registered public accounting firm, has audited the effectiveness of our internal control over financial reporting as of December 31, 2022, as stated in their report, which is included in Part II Item 8 of this Annual Report.

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, 2022 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information

None.

Item 9C. Disclosure Regarding Foreign Jurisdictions that Prevent Inspections

None.

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 2023 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2022.

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.precigen.com*) under "Corporate Governance." We will provide a copy of this document, without charge, upon request, by writing to us at Precigen, Inc., 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 2023 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2022.

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 2023 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2022.

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 2023 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2022.

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 2023 Annual Meeting of Shareholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2022.

PART IV

Item 15. Exhibits, Financial Statement Schedules

(a) The following documents are filed as part of this Annual Report:

1. Financial Statements.

Consolidated Financial Statements of Precigen, Inc. and Subsidiaries

Reports of Independent Registered Public Accounting Firm

Consolidated Balance Sheets as of December 31, 2022 and 2021

Consolidated Statements of Operations for the Years Ended December 31, 2022, 2021, and 2020

Consolidated Statements of Comprehensive Loss for the Years Ended December 31, 2022, 2021, and 2020

Consolidated Statements of Shareholders' and Total Equity for the Years Ended December 31, 2022, 2021, and 2020

Consolidated Statements of Cash Flows for the Years Ended December 31, 2022, 2021, and 2020

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
2.1*	Membership Interest Purchase Agreement dated July 1, 2022 by and among Precigen, Inc., Trans Ova Genetics, L.C. and Spring Bidco LLC, originally filed as Exhibit 2.1 to Precigen's Form 8-K filed with the SEC on July 5, 2022, which is incorporated by reference herein
2.2*	Guarantee by and among Precigen, Inc., Trans Ova Genetics, L.C., Spring Bidco LLC and Houdstermaatschappij Wilg B.V., dated as of July 1, 2022, originally filed as Exhibit 2.2 to Precigen's Form 8-K filed with the SEC on July 5, 2022, which is incorporated by reference herein
3.1*	Amended and Restated Articles of Incorporation (16)
3.2*	Amended and Restated Bylaws (19)
4.1*	Specimen certificate evidencing shares of common stock (21)
4.2*	Form of Second Amended and Restated Warrant to Purchase Shares of Common Stock (1)
4.3*	Base Indenture, dated July 3, 2018, by and between the Company and The Bank of New York Mellon Trust Company, N.A. (10)
4.4*	First Supplemental Indenture (including the form of 3.50% convertible senior notes due 2023), dated July 3, 2018, by and between the Company and The Bank of New York Mellon Trust Company, N.A. (10)
4.5	Description of Securities (17)

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10.1†*	<u>Amended and Restated 2008 Equity Incentive Plan of the Company</u> (1)
10.2†*	<u>Amended and Restated 2013 Omnibus Incentive Plan of the Company, effective as of June 9, 2014</u> (4)
10.2A†*	<u>Amended and Restated 2013 Omnibus Incentive Plan of the Company, Form of Restricted Stock Agreement</u> (4)
10.2B†*	<u>Amended and Restated 2013 Omnibus Incentive Plan of the Company, Form of Incentive Stock Option Agreement</u> (4)
10.2C†*	<u>Amended and Restated 2013 Omnibus Incentive Plan of the Company, Form of Nonqualified Stock Option Agreement</u> (4)
10.2D†*	<u>Amendment to the Amended and Restated 2013 Omnibus Incentive Plan of the Company, effective as of June 11, 2015</u> (5)
10.2E†*	<u>Amendment to the Amended and Restated 2013 Omnibus Incentive Plan of the Company, effective as of June 9, 2016</u> (6)
10.2F†*	<u>Amendment to the Amended and Restated 2013 Omnibus Incentive Plan of the Company, effective as of June 28, 2017</u> (7)
10.2G†*	<u>Amendment to the Amended and Restated 2013 Omnibus Incentive Plan of the Company, as amended, effective as of June 7, 2018</u> (9)
10.2H†*	<u>Amendment to the Amended and Restated 2013 Omnibus Incentive Plan of the Company, as amended, effective as of June 12, 2019</u> (13)
10.2I†*	<u>Amendment to the Amended and Restated 2013 Omnibus Incentive Plan of the Company, as amended, effective January 5, 2020</u> (18)
10.2J†*	<u>Amendment to the Amended and Restated 2013 Omnibus Incentive Plan of the Company, as amended, effective as of June 19, 2020</u> (20)
10.2K†*	<u>2013 Amended and Restated Omnibus Incentive Plan of the Company, as amended, Form of Restricted Stock Unit Agreement for Officers</u> (8)
10.2L†*	<u>2013 Amended and Restated Omnibus Incentive Plan of the Company, as amended, Form of Restricted Stock Unit Agreement for Directors</u> (8)
10.3*	<u>2019 Incentive Plan of the Company for Non-Employee Service Providers, effective as of June 12, 2019</u> (13)
10.4†*	<u>Form of Continuing Employment Agreement</u> (12)
10.5†*	<u>Employment Agreement, dated January 1, 2020, by and between the Company and Helen Sabzevari, Ph.D.</u> (15)
10.6†*	<u>Executive Chairman Compensation Arrangement, by and between the Company and Randal J. Kirk</u> (23)
10.7#*	<u>Exclusive Channel Collaboration Agreement, dated as of March 26, 2014, by and between the Company and Intrexon Energy Partners, LLC</u> (2)
10.8#*	<u>Amended and Restated Limited Liability Company Agreement of Intrexon Energy Partners, LLC, dated as of March 26, 2014, by and among the Company and the parties thereto</u> (2)
10.9*	<u>Securities Issuance Agreement by and among the Company, 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</u> (3)
10.10#*	<u>Exclusive License Agreement, dated October 5, 2018, by and between Precigen, Inc. and ZIOPHARM Oncology, Inc.</u> (11)
10.11*	<u>Share Lending Agreement, dated June 28, 2018, by and between the Company, J.P. Morgan Securities LLC and JPMorgan Chase Bank, National Association, New York Branch</u> (10)
10.12*	<u>Stock and Asset Purchase Agreement, dated January 1, 2020, by and between the Company and TS Biotechnology Holdings, LLC</u> (14)
21.1	<u>List of Subsidiaries of Precigen, Inc.</u>
23.1	<u>Consent of Deloitte & Touche LLP</u>

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- 31.1 [Certification of Helen Sabzevari, Chief Executive Officer \(Principal Executive Officer\) of Precigen, Inc., 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 Harry Thomasian Jr., Chief Financial Officer \(Principal Financial Officer\) of Precigen, Inc., 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](#)
- 32.1** [Certification of Helen Sabzevari, Chief Executive Officer \(Principal Executive Officer\) of Precigen, Inc., 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 Harry Thomasian Jr., Chief Financial Officer \(Principal Financial Officer\) of Precigen, Inc., 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 (Precigen, Inc. and Subsidiaries Consolidated Financial Statements for the years ended December 31, 2022, 2021, and 2020, formatted in Inline 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, 2022 and 2021, (ii) the Consolidated Statements of Operations for the years ended December 31, 2022, 2021, and 2020, (iii) the Consolidated Statements of Shareholders' and Total Equity for the years ended December 31, 2022, 2021, and 2020, (iv) the Consolidated Statements of Cash Flows for the years ended December 31, 2022, 2021, and 2020 and (v) the Notes to the Consolidated Financial Statements.
- 104** Cover Page Interactive Data File (embedded within the Inline XBRL document)

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

- (1) Amendment No. 1 to Registration Statement on Form S-1, filed with the Securities and Exchange Commission on July 29, 2013.
- (2) Current Report on Form 8-K/A, filed with the Securities and Exchange Commission on April 4, 2014.
- (3) Current Report on Form 8-K, filed with the Securities and Exchange Commission on January 14, 2015.
- (4) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 13, 2014.
- (5) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 17, 2015.
- (6) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 13, 2016.
- (7) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 30, 2017.
- (8) Annual Report on Form 10-K, filed with the Securities and Exchange Commission on March 1, 2018.
- (9) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 8, 2018.
- (10) Current Report on Form 8-K, filed with the Securities and Exchange Commission on July 3, 2018.
- (11) Quarterly Report on Form 10-Q, filed with the Securities and Exchange Commission on November 8, 2018.
- (12) Quarterly Report on Form 10-Q, filed with the Securities and Exchange Commission on May 9, 2019.
- (13) Quarterly Report on Form 10-Q, filed with the Securities and Exchange Commission on August 9, 2019.
- (14) Current Report on Form 8-K, filed with the Securities and Exchange Commission on January 2, 2020.
- (15) Current Report on Form 8-K, filed with the Securities and Exchange Commission on January 7, 2020.
- (16) Current Report on Form 8-K, filed with the Securities and Exchange Commission on February 4, 2020.
- (17) Annual Report on Form 10-K, filed with the Securities and Exchange Commission on March 2, 2020.
- (18) Quarterly Report on Form 10-Q, filed with the Securities and Exchange Commission on May 11, 2020.
- (19) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 4, 2020.
- (20) Current Report on Form 8-K, filed with the Securities and Exchange Commission on June 19, 2020.
- (21) Registration Statement on Form S-3, filed with the Securities and Exchange Commission on June 22, 2020.
- (22) Quarterly Report on Form 10-Q, filed with the Securities and Exchange Commission on November 9, 2020.

** Furnished herewith

† Indicates management contract or compensatory plan.

Portions of the exhibit (indicated by asterisks) have been omitted in compliance with Item 601 of Regulation S-K.

(c) Financial Statement Schedules

The response to Item 15(a)2 is incorporated herein by reference.

Item 16. Form 10-K Summary

None.

SIGNATURES

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

Dated: March 6, 2023

PRECIGEN, INC.

By: /S/ HELEN SABZEVARI

Helen Sabzevari
Chief Executive Officer and Director

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
<u> /S/ HELEN SABZEVARI </u> Helen Sabzevari	Chief Executive Officer and Director (Principal Executive Officer)	3/6/2023
<u> /S/ HARRY THOMASIAN JR. </u> Harry Thomasian Jr.	Chief Financial Officer (Principal Accounting and Financial Officer)	3/6/2023
<u> /S/ RANDAL J. KIRK </u> Randal J. Kirk	Executive Chairman	3/6/2023
<u> /S/ CESAR L. ALVAREZ </u> Cesar L. Alvarez	Director	3/6/2023
<u> /S/ STEVEN FRANK </u> Steven Frank	Director	3/6/2023
<u> /S/ VINITA D. GUPTA </u> Vinita D. Gupta	Director	3/6/2023
<u> /S/ FRED HASSAN </u> Fred Hassan	Director	3/6/2023
<u> /S/ JEFFREY B. KINDLER </u> Jeffrey B. Kindler	Director	3/6/2023
<u> /S/ DEAN J. MITCHELL </u> Dean J. Mitchell	Director	3/6/2023
<u> /S/ ROBERT B. SHAPIRO </u> Robert B. Shapiro	Director	3/6/2023
<u> /S/ JAMES S. TURLEY </u> James S. Turley	Director	3/6/2023

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Precigen, Inc. and Subsidiaries
Consolidated Financial Statements
December 31, 2022, 2021, and 2020

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the shareholders and the Board of Directors of Precigen, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Precigen, Inc. and subsidiaries (the "Company") as of December 31, 2022 and 2021, the related consolidated statements of operations, comprehensive income (loss), shareholders' equity, and cash flows, for each of the three years in the period ended December 31, 2022, and the related notes (collectively referred to as the "financial statements"). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2022, in conformity with accounting principles generally accepted in the United States of America.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of December 31, 2022, based on criteria established in *Internal Control — Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission and our report dated March 6, 2023, expressed an unqualified opinion on the Company's internal control over financial reporting.

Basis for Opinion

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

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matter

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

Goodwill - Exemplar Reporting Unit - Refer to Notes 2 and 10 to the financial statements

Critical Audit Matter Description

The Company's goodwill balance was \$36.9 million as of December 31, 2022, of which \$20.1 million is allocated to the Exemplar reporting unit. The Company's evaluation of goodwill for impairment involves the comparison of the fair value of the reporting unit to its carrying amount. The forecast used in the Company's estimation of fair value was developed by management based on historical operating results, incorporating adjustments to reflect management's planned changes in operations and market considerations. The discount rate utilizes a risk adjusted weighted average cost of capital. Given the significant estimates and assumptions management makes to estimate the fair value of the Exemplar reporting unit and the sensitivity of Exemplar's valuation to changes in these estimates, performing audit procedures to evaluate the reasonableness of management's estimates and assumptions required a high degree of auditor judgment and an increased extent of effort, including the need to involve our fair value specialists.

How the Critical Audit Matter Was Addressed in the Audit

Our audit procedures related to the forecasts of future revenues, operating margins, cash flow ("forecasts"), and the selection of the discount rate for the Exemplar reporting unit included the following, among others:

- We tested the operating effectiveness of controls over management's goodwill impairment evaluation, including those over the determination of the Exemplar reporting unit's fair value, such as controls related to management's forecasts and selection of the discount rate.

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- We evaluated management's ability to accurately forecast revenues and operating margins by comparing actual results to management's historical forecasts, as well as external information.
- We evaluated the reasonableness of management's forecasts by comparing the forecasts to (1) historical results, (2) internal communications to management and the Board of Directors, (3) industry growth projections, and (4) forecasted information prepared in the prior year.
- With the assistance of our fair value specialists, we evaluated the discount rate, including testing the underlying source information and the mathematical accuracy of the calculations, and developing a range of independent estimates and comparing those to the discount rate selected by management.

/s/ Deloitte & Touche LLP

Baltimore, Maryland

March 6, 2023

We have served as the Company's auditor since 2019.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the shareholders and the Board of Directors of Precigen, Inc.

Opinion on Internal Control over Financial Reporting

We have audited the internal control over financial reporting of Precigen, Inc. and subsidiaries (the “Company”) as of December 31, 2022, based on criteria established in *Internal Control — Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2022, based on criteria established in *Internal Control — Integrated Framework (2013)* issued by COSO.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated financial statements as of and for the year ended December 31, 2022, of the Company and our report dated March 6, 2023, expressed an unqualified opinion on those financial statements.

Basis for Opinion

The Company’s management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management’s Annual Report on Internal Control Over Financial Reporting. Our responsibility is to express an opinion on the Company’s internal control over financial reporting based on our audit. We are a public accounting firm registered with the 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 audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

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 (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company’s assets that could have a material effect on the financial statements.

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/ Deloitte & Touche LLP

Baltimore, Maryland
March 6, 2023

Precigen, Inc. and Subsidiaries
Consolidated Balance Sheets
December 31, 2022 and 2021

(Amounts in thousands, except share data)	2022	2021
Assets		
Current assets		
Cash and cash equivalents	\$ 4,858	\$ 36,423
Restricted cash	43,339	—
Short-term investments	51,092	72,240
Receivables		
Trade, less allowance for credit losses of \$184 as of both December 31, 2022 and 2021	959	1,341
Related parties, less allowance for credit losses of \$0 and \$1,509 as of December 31, 2022 and 2021	19	73
Other	12,826	566
Inventory	287	326
Prepaid expenses and other	4,779	5,471
Current assets held for sale	—	40,188
Total current assets	118,159	156,628
Long-term investments	—	48,562
Property, plant and equipment, net	7,329	8,599
Intangible assets, net	44,455	52,291
Goodwill	36,923	37,554
Right-of-use assets	8,086	9,990
Other assets	1,025	936
Noncurrent assets held for sale	—	45,296
Total assets	<u>\$ 215,977</u>	<u>\$ 359,856</u>

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

Precigen, Inc. and Subsidiaries
Consolidated Balance Sheets
December 31, 2022 and 2021

(Amounts in thousands, except share data)	2022	2021
Liabilities and Shareholders' Equity		
Current liabilities		
Accounts payable	\$ 4,068	\$ 3,112
Accrued compensation and benefits	6,377	7,856
Other accrued liabilities	23,747	7,817
Deferred revenue	25	1,490
Current portion of long-term debt	43,219	52
Current portion of lease liabilities	1,209	1,393
Related party payables	—	74
Current liabilities held for sale	—	12,851
Total current liabilities	78,645	34,645
Long-term debt, net of current portion	—	179,882
Deferred revenue, net of current portion, including \$0 and \$21,205 from related parties as of December 31, 2022 and 2021	1,818	23,023
Lease liabilities, net of current portion	6,992	8,747
Deferred tax liabilities	2,263	2,539
Long-term liabilities held for sale	—	3,672
Total liabilities	89,718	252,508
Commitments and contingencies (Note 16)		
Shareholders' equity		
Common stock, no par value, 400,000,000 shares authorized as of December 31, 2022 and 2021; and 208,150,021 shares and 206,739,874 shares issued and outstanding as of December 31, 2022 and 2021, respectively	—	—
Additional paid-in capital	1,998,314	2,022,701
Accumulated deficit	(1,868,567)	(1,915,556)
Accumulated other comprehensive (loss) income	(3,488)	203
Total shareholders' equity	126,259	107,348
Total liabilities and shareholders' equity	\$ 215,977	\$ 359,856

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

Precigen, Inc. and Subsidiaries
Consolidated Statements of Operations
Years Ended December 31, 2022, 2021, and 2020

(Amounts in thousands, except share and per share data)	2022	2021	2020
Revenues			
Collaboration and licensing revenues, including \$14,561, \$0, and \$3,053 from related parties in 2022, 2021, and 2020, respectively	\$ 14,661	\$ 506	\$ 21,208
Product revenues	1,903	2,164	2,435
Service revenues	10,094	11,095	7,627
Other revenues	251	502	722
Total revenues	<u>26,909</u>	<u>14,267</u>	<u>31,992</u>
Operating Expenses			
Cost of products and services	6,339	5,745	5,374
Research and development	47,170	47,933	39,428
Selling, general and administrative	48,006	51,994	72,694
Impairment of goodwill	482	—	—
Impairment of other noncurrent assets	638	543	814
Total operating expenses	<u>102,635</u>	<u>106,215</u>	<u>118,310</u>
Operating loss	(75,726)	(91,948)	(86,318)
Other Expense, Net			
Interest expense	(6,774)	(18,755)	(18,209)
Interest and dividend income	133	171	1,006
Other income (expense), net	1,539	(432)	(400)
Total other expense, net	<u>(5,102)</u>	<u>(19,016)</u>	<u>(17,603)</u>
Equity in net income (loss) of affiliates	862	(3)	(603)
Loss from continuing operations before income taxes	<u>(79,966)</u>	<u>(110,967)</u>	<u>(104,524)</u>
Income tax benefit	189	160	82
Loss from continuing operations	<u>(79,777)</u>	<u>(110,807)</u>	<u>(104,442)</u>
Income (loss) from discontinued operations, net of income tax benefit	108,094	18,641	(66,079)
Net Income (loss)	<u>\$ 28,317</u>	<u>\$ (92,166)</u>	<u>\$ (170,521)</u>
Net Income (loss) per Share			
Net loss from continuing operations per share, basic and diluted	\$ (0.40)	\$ (0.56)	\$ (0.63)
Net income (loss) from discontinued operations per share, basic and diluted	0.54	0.09	(0.39)
Net Income (loss) per share, basic and diluted	<u>\$ 0.14</u>	<u>\$ (0.47)</u>	<u>\$ (1.02)</u>
Weighted average shares outstanding, basic and diluted	<u>200,360,821</u>	<u>197,759,900</u>	<u>167,065,539</u>

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

Precigen, Inc. and Subsidiaries
Consolidated Statements of Comprehensive Income (loss)
Years Ended December 31, 2022, 2021, and 2020

(Amounts in thousands)	2022	2021	2020
Net income (loss)	\$ 28,317	\$ (92,166)	\$ (170,521)
Other comprehensive income (loss):			
Unrealized gain (loss) on investments	(431)	(344)	6
Gain (loss) on foreign currency translation adjustments	(3,262)	(3,450)	4,502
Release of cumulative foreign currency translation adjustments to net loss from discontinued operations	—	—	26,957
Comprehensive Income (loss)	<u>\$ 24,624</u>	<u>\$ (95,960)</u>	<u>\$ (139,056)</u>

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

Precigen, Inc. and Subsidiaries
Consolidated Statements of Shareholders' Equity
Years Ended December 31, 2022, 2021, and 2020

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Income (Loss)	Accumulated Deficit	Total Shareholders' Equity
	Shares	Amount				
(Amounts in thousands, except share data)						
Balances at December 31, 2019	163,274,880	\$ —	\$ 1,752,048	\$ (27,468)	\$ (1,652,869)	\$ 71,711
Stock-based compensation expense	—	—	18,366	—	—	18,366
Shares issued upon vesting of restricted stock units and for exercises of stock options and warrants	877,249	—	117	—	—	117
Shares issued for accrued compensation	1,955,405	—	5,100	—	—	5,100
Shares issued as payment for services	413,911	—	1,006	—	—	1,006
Shares issued in private placement	5,972,696	—	35,000	—	—	35,000
Shares issued upon conversion of long-term debt	13,051,802	—	56,827	—	—	56,827
Shares issued in conjunction with settlement agreement	2,117,264	—	18,103	—	—	18,103
Net loss	—	—	—	—	(170,521)	(170,521)
Release of cumulative translation adjustments to loss from discontinued operations	—	—	—	26,957	—	26,957
Other comprehensive income	—	—	—	4,508	—	4,508
Balances at December 31, 2020	187,663,207	\$ —	\$ 1,886,567	\$ 3,997	\$ (1,823,390)	\$ 67,174

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

Precigen, Inc. and Subsidiaries
Consolidated Statements of Shareholders' Equity
Years Ended December 31, 2022, 2021, and 2020

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Income	Accumulated Deficit	Total Shareholders' Equity
	Shares	Amount				
(Amounts in thousands, except share data)						
Balances at December 31, 2020	187,663,207	\$ —	\$ 1,886,567	\$ 3,997	\$ (1,823,390)	\$ 67,174
Stock-based compensation expense	—	—	13,904	—	—	13,904
Shares issued upon vesting of restricted stock units and for exercises of stock options	1,751,896	—	608	—	—	608
Shares issued as payment for services	74,771	—	577	—	—	577
Shares issued in public offering, net of issuance costs	17,250,000	—	121,045	—	—	121,045
Net loss	—	—	—	—	(92,166)	(92,166)
Other comprehensive loss	—	—	—	(3,794)	—	(3,794)
Balances at December 31, 2021	206,739,874	\$ —	\$ 2,022,701	\$ 203	\$ (1,915,556)	\$ 107,348

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

Precigen, Inc. and Subsidiaries
Consolidated Statements of Shareholders' Equity
Years Ended December 31, 2022, 2021, and 2020

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Income (Loss)	Accumulated Deficit	Total Shareholders' Equity
	Shares	Amount				
(Amounts in thousands, except share data)						
Balances at December 31, 2021	206,739,874	\$ —	\$ 2,022,701	\$ 203	\$ (1,915,556)	\$ 107,348
Cumulative effect of adoption of ASU 2020-06	—	—	(36,868)	—	18,672	(18,196)
Stock-based compensation expense	—	—	10,207	—	—	10,207
Shares issued upon vesting of restricted stock units and for exercises of stock options	354,089	—	1	—	—	1
Shares issued for accrued compensation	772,071	—	1,698	—	—	1,698
Shares issued as payment for services	283,987	—	575	—	—	575
Net Income	—	—	—	—	28,317	28,317
Other comprehensive loss	—	—	—	(3,691)	—	(3,691)
Balances at December 31, 2022	208,150,021	\$ —	\$ 1,998,314	\$ (3,488)	\$ (1,868,567)	\$ 126,259

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

Precigen, Inc. and Subsidiaries
Consolidated Statements of Cash Flows
Years Ended December 31, 2022, 2021, and 2020

(Amounts in thousands)	2022	2021	2020
Cash flows from operating activities			
Net income (loss)	\$ 28,317	\$ (92,166)	\$ (170,521)
Adjustments to reconcile net income (loss) to net cash used in operating activities:			
Depreciation and amortization	10,765	13,761	17,516
Loss on disposals of assets, net	421	150	4,442
Impairment of goodwill	482	—	9,635
Impairment of other noncurrent assets	638	543	13,326
Gain on sale of discontinued operations	(94,702)	—	(672)
Loss on release of cumulative foreign currency translation adjustments to loss from discontinued operations	—	—	26,957
Loss on settlement agreement	—	—	11,436
Gain on debt retirement	(961)	—	—
Unrealized and realized depreciation on equity securities and preferred stock, net	—	—	106
Amortization of premiums (discounts) on investments, net	832	1,232	(699)
Equity in net (income) loss of affiliates	(862)	3	1,176
Stock-based compensation expense	10,206	13,904	18,366
Shares issued as payment for services	576	577	1,006
Provision for credit losses	944	1,268	899
Accretion of debt discount and amortization of deferred financing costs	1,042	11,735	10,587
Deferred income taxes	(150)	(167)	(156)
Noncash (gain) loss on termination of leases	—	(5,831)	191
Other noncash items	106	24	35
Changes in operating assets and liabilities:			
Receivables:			
Trade	(2,229)	(6,176)	2,214
Related parties	54	(54)	258
Other	(11,338)	(330)	1,853
Inventory	2,341	(1,903)	2,511
Prepaid expenses and other	289	520	(812)
Other assets	(101)	305	(142)
Accounts payable	379	420	(1,097)
Accrued compensation and benefits	(37)	2,853	(789)
Other accrued liabilities	11,561	1,850	(2,682)
Deferred revenue	(23,396)	1,656	(21,045)
Lease liabilities	(107)	97	(887)
Related party payables	(78)	8	(33)
Other long-term liabilities	(37)	(50)	—
Net cash used in operating activities	(65,045)	(55,771)	(77,021)

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

Precigen, Inc. and Subsidiaries
Consolidated Statements of Cash Flows
Years Ended December 31, 2022, 2021, and 2020

(Amounts in thousands)	2022	2021	2020
Cash flows from investing activities			
Purchases of investments	—	(174,221)	(171,360)
Sales and maturities of investments	68,441	100,168	133,000
Purchases of property, plant and equipment	(4,924)	(7,247)	(7,527)
Proceeds from sale of assets	594	3,006	6,484
Proceeds from sale of discontinued operations	162,306	—	64,240
Proceeds from repayment of notes receivable	—	3,754	2,942
Net cash provided by (used in) investing activities	<u>226,417</u>	<u>(74,540)</u>	<u>27,779</u>
Cash flows from financing activities			
Proceeds from issuance of shares and warrants, net of issuance costs	—	121,045	35,000
Advances from lines of credit	—	—	10,005
Repayments of advances from lines of credit	—	—	(11,927)
Payments of long-term debt	(154,705)	(466)	(490)
Payments of cost to retire long-term debt	(588)	—	—
Proceeds from stock option and warrant exercises	1	608	117
Payment of stock issuance costs	—	—	—
Net cash (used in) provided by financing activities	<u>(155,292)</u>	<u>121,187</u>	<u>32,705</u>
Effect of exchange rate changes on cash, cash equivalents, and restricted cash	(827)	217	353
Net increase (decrease) in cash, cash equivalents, and restricted cash	5,253	(8,907)	(16,184)
Cash, cash equivalents, and restricted cash			
Beginning of year	43,343	52,250	68,434
End of year	<u>\$ 48,596</u>	<u>\$ 43,343</u>	<u>\$ 52,250</u>

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

Precigen, Inc. and Subsidiaries
Consolidated Statements of Cash Flows
Years Ended December 31, 2022, 2021, and 2020

(Amounts in thousands)	2022	2021	2020
Supplemental disclosure of cash flow information			
Cash paid during the period for interest	\$ 8,535	\$ 7,155	\$ 7,202
Cash paid during the period for income taxes	—	36	48
Significant noncash activities			
Fair value of stock issued upon conversion of long-term debt	—	—	56,827
Fair value of stock issued in conjunction with settlement agreement	—	—	18,103
Accrued compensation paid in equity awards	1,698	—	5,100
Purchases of property and equipment included in accounts payable and other accrued liabilities	40	820	277
Proceeds from sale of assets included in receivables	—	14	4,227

The following table provides a reconciliation of the cash, cash equivalents, and restricted cash balances as of December 31, 2022 and 2021 as shown above:

	2022	2021
Cash and cash equivalents	\$ 4,858	\$ 36,423
Restricted cash	43,339	—
Cash and cash equivalents included in current assets held for sale or abandonment	—	6,497
Restricted cash included in other assets	399	423
Cash, cash equivalents, and restricted cash	<u>\$ 48,596</u>	<u>\$ 43,343</u>

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

Precigen, Inc. and Subsidiaries
Notes to the Consolidated Financial Statements
(Amounts in thousands, except share and per share data)

1. Organization and Basis of Presentation

Precigen, Inc. ("Precigen"), a Virginia corporation, through its wholly owned subsidiary, PGEN Therapeutics, Inc. ("PGEN Therapeutics"), is a dedicated discovery and clinical-stage biopharmaceutical company advancing the next generation of gene and cell therapies with the overall goal of improving outcomes for patients with significant unmet medical needs. PGEN Therapeutics is leveraging its proprietary technology platforms to develop product candidates designed to target urgent and intractable diseases in its core therapeutic areas of immuno-oncology, autoimmune disorders, and infectious diseases. PGEN Therapeutics has developed an extensive pipeline of therapies across multiple indications within these core focus areas. PGEN Therapeutics' primary operations are located in Maryland.

Precigen has two additional wholly owned operating subsidiaries. Precigen ActoBio, Inc. ("ActoBio") is pioneering a proprietary class of microbe-based biopharmaceuticals that enable expression and local delivery of disease-modifying therapeutics, with its primary operations located in Ghent, Belgium.

Exemplar Genetics, LLC, doing business as Precigen Exemplar ("Exemplar"), is committed to enabling the study of life-threatening human diseases through the development of MiniSwine Yucatan miniature pig research models and services, as well as enabling the production of cells and organs in its genetically engineered swine for regenerative medicine applications. Exemplar's primary operations are located in Iowa.

Discontinued Operations

On January 31, 2020, Precigen completed the sale of the majority of its non-healthcare assets and operations to an affiliate of Third Security, which are presented as discontinued operations for all periods presented. See Notes 3 and 13 for further discussion.

Beginning in the second quarter of 2020, the Company suspended its proprietary methane bioconversion platform operations and began the process to wind down MBP Titan's activities and had substantially completed the wind down by December 31, 2020, with the final disposition of certain property and equipment and the facility operating lease occurring in January 2021. With the exception of certain assets and obligations with which the Company has a continuing involvement after the wind down, MBP Titan has been presented as discontinued operations for all periods presented. See Note 3 for further discussion.

On August 18, 2022, Precigen completed the sale of 100% of the issued and outstanding membership interests in its wholly-owned subsidiary, Trans Ova Genetics, L.C. ("Trans Ova"), a provider of reproductive technologies, including services and products sold to cattle breeders and other producers. See Note 3 for further discussion. Trans Ova was formerly a separate reportable segment.

Precigen and its consolidated subsidiaries are hereinafter collectively referred to as the "Company."

Liquidity

Management believes that existing liquid assets as of December 31, 2022, as well as the proceeds from the January 2023 public offering discussed in Note 13, will allow the Company to continue its operations for at least a year from the issuance date of these consolidated financial statements. 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"). The Company is subject to a number of risks similar to those of other companies conducting high-risk, early-stage research and development of therapeutic product candidates. Principal among these risks are dependence on key individuals and intellectual property, competition from other products and companies, and the technical risks associated with the successful research, development, and clinical manufacturing of its therapeutic product candidates. Additionally, the accompanying consolidated financial statements have been prepared on a going concern basis, which contemplates the realization of assets and the satisfaction of liabilities in the normal course of business. During the year ended December 31, 2022, the Company incurred a loss from continuing operations of \$79,777 and, as of December 31, 2022, had an accumulated deficit of \$1,868,567. 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. In the absence of a significant source of recurring revenue, the Company's long-term success is dependent upon its ability to continue to raise additional capital in order to fund ongoing research and development, obtain regulatory approval of its therapeutics product candidates, successfully

commercialize its therapeutics product candidates, generate revenue, meet its obligations and, ultimately, attain profitable operations.

2. Summary of Significant Accounting Policies

Principles of Consolidation

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

Risks and Uncertainties

The Company is subject to a number of risks similar to those of other companies conducting high-risk, early-stage research and development of therapeutic product candidates. Principal among these risks are dependence on key individuals and intellectual property, competition from products and companies, and the technical risks associated with the successful research, development and clinical manufacturing of its therapeutic product candidates.

The Company is closely monitoring the impact of COVID-19 on all aspects of its businesses. Given the dynamic nature of these circumstances, the full impact of the COVID-19 pandemic on the Company's ongoing business, results of operations, and overall financial performance in future periods cannot be reasonably estimated at this time, and it could have a material adverse effect on the Company's results of operations, cash flows, and financial position, including resulting impairments to goodwill and long-lived assets and additional credit losses.

See Note 3 for further discussion of the impact of COVID-19 on MBP Titan.

Revenue Recognition

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 Financial Accounting Standards Board ("FASB") Accounting Standards Codification ("ASC") Topic 606, *Revenue from Contracts with Customers* ("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 has historically generated collaboration and licensing revenues through agreements with collaborators (known as exclusive channel collaborations 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. Options to acquire additional services are considered to determine if they constitute material rights. 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. 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 as revenue.

Product and service revenues

The Company's product and service revenues are generated primarily through Exemplar which generates product and service revenues through the development and sale of genetically engineered miniature swine models. The Company evaluates each promised product or service under its contracts and identifies performance obligations for each distinct product or service. The Company then allocates the transaction price of the contract to each performance obligation, recognizing the transaction price as revenue at a point in time when control of the promised product or over time when the promised service is rendered. We typically recognize revenue using an out-based measure, generally time elapsed or days of service, to measure progress and

transfer of the control of the performance obligation to the customer. Payment terms are typically due within 30 days of invoicing, which occurs prior to or when revenue is recognized.

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, contract research organizations and 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, 2022 and 2021, the Company had research and development commitments with third parties that had not yet been incurred totaling \$19,909 and \$22,301, respectively. The commitments are generally cancellable by the Company by providing written notice at least sixty days before the desire termination date.

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, 2022 and 2021, the Company had cash equivalent investments in highly liquid money market accounts at major financial institutions of \$2,985 and \$20,697, respectively, which is included in cash and cash equivalents in the accompanying consolidated balance sheets.

Restricted Cash

Included in the Consolidated Balance Sheet as of December 31, 2022, is restricted cash of \$43,339. This cash is restricted for the permitted purposes related to our Convertible Notes, including the resolution of such notes.

Short-term and Long-Term Investments

As of December 31, 2022 and 2021 short-term and long-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.

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 fixed rate securities holdings, the Company's investment portfolio is susceptible to changes in interest rates. As of December 31, 2022, 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. Although the Company has no intent to liquidate such investments, 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 manages 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 has accounted for its investment in its joint ventures ("JVs") using the equity method of accounting based upon relative ownership interest. At December 31, 2022, the Company no longer held any investments in JVs. See additional discussion related to certain of the Company's historical JVs in Note 4.

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 ("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, 2021, the Company determined that certain of its collaborators and JVs 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. In July 2022, the Company obtained substantially all of the membership interests that were previously owned by others of these VIEs, and began consolidating those entities at the time of the acquisitions. The operations and financial position of those entities were not material as of or for the period ended July 2022. See Note 4 and Note 16 for additional discussion. During the quarter ended December 31, 2022, these VIEs were liquidated.

Accounts Receivable

The Company's expected loss allowance methodology for accounts receivable is developed using historical collection experience, current and future economic and market conditions, and a review of the current status of accounts receivables. Balances are written off at the point when collection attempts have been exhausted.

Estimates are used to determine the loss allowance, which is based on assessment of anticipated payment and other historical, current, and future information that is reasonably available.

The following table shows the activity in the allowance for credit losses for the years ended December 31, 2022, 2021, and 2020:

	2022	2021	2020
Beginning balance	\$ 1,693	\$ 1,509	\$ 2,312
Charged to operating expenses	—	140	—
Write offs of accounts receivable, net of recoveries	(1,509)	44	(803)
Ending balance	<u>184</u>	<u>1,693</u>	<u>1,509</u>

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 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 from continuing operations are as follows:

	Years
Land improvements	9–15
Buildings and building improvements	9–15
Furniture and fixtures	4–7
Equipment	2–7
Breeding stock	2
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 eleven years.

Operating Leases

The Company determines if an arrangement is a lease at inception. Operating leases are included as right-of-use assets ("ROU Assets") and lease liabilities on the consolidated balance sheets. The Company has elected not to recognize ROU Assets or lease liabilities for leases with lease terms of one year or less.

Lease liabilities are recognized based on the present value of the future minimum lease payments over the lease term at commencement date. The initial measurement of the ROU Asset also includes any lease payments made, adjusted for lease incentives. For leases that contain fixed non-lease payments, the Company accounts for the lease and non-lease components as a single lease component. Variable lease payments, which primarily include payments for non-lease components such as maintenance costs, are excluded from the ROU Assets and lease liabilities and are recognized in the period in which the obligation for those payments is incurred. As the Company's operating leases do not provide an implicit interest rate, the Company uses its incremental borrowing rate at the lease commencement date, which is the estimated rate the Company would be required to pay for a collateralized borrowing equal to the total lease payments over the term of the lease, in determining the present value of future payments. The lease term for all of the Company's leases includes the noncancelable period of the lease plus any additional periods covered by options that the Company is reasonably certain to exercise, either to extend or to not terminate the lease. Lease expense is recognized on a straight-line basis over the lease term.

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 may elect to perform 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 quantitative 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 quantitative goodwill impairment test is not required.

When a the quantitative goodwill impairment test is performed, 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, 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 on December 31 and performs increment impairment reviews if a triggering event occurs prior to the annual impairment review.

When the Company performs quantitative evaluations, the fair value of the reporting units are primarily determined based on the income approach. The income approach is a valuation technique in which fair value is based from forecasted future cash flows, discounted at the appropriate rate of return commensurate with the risk as well as current rates of return for equity and debt capital as of the valuation date. The forecast used in the Company's estimation of fair value was developed by management based on historical operating results, incorporating adjustments to reflect management's planned changes in operations and market considerations. The discount rate utilizes a risk adjusted weighted average cost of capital.

See Notes 3 and 10 for additional discussion regarding goodwill impairment charges recorded in the year ended December 31, 2022 and 2020.

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.

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 eighteen 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, ROU Assets, 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.

See Notes 3 and 9 for additional discussion of impairment of long-lived assets for the years ended December 31, 2022, 2021 and 2020.

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.

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.

The Company accounts for the minimum tax on global intangible low-taxed income ("GILTI") as a period charge in the period in which the tax arises. There was no impact from GILTI to the accompanying consolidated financial statements.

Share-Based Payments

Precigen 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. Through 2019, since Precigen did not have sufficient history to estimate the expected volatility of its common stock price, expected volatility was based on a blended approach that utilized the volatility of Precigen's common stock and the volatility of peer public entities that were similar in size and industry. Beginning in 2020, for stock options with an expected term where there is sufficient history available, expected volatility is based on the volatility of Precigen's common stock. For any stock options where sufficient history is not available for the expected term, expected volatility is based on the blended approach discussed above. Precigen estimates the expected term of options based on previous history of exercises unless certain terms of the stock option require a different expected term that more appropriately reflects the estimated life of the stock option.

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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 Precigen 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, 2022, 2021, and 2020 are set forth in the table below:

	2022	2021	2020
Valuation assumptions			
Expected dividend yield	0%	0%	0%
Expected volatility	87%–89%	87%–90%	59%–90%
Expected term (years)	6.25	6.00	6.00–10.00
Risk-free interest rate	1.64%–4.12%	0.61%–1.33%	0.36%–1.80%

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 Income (Loss) per Share

Basic net income (loss) per share is calculated by dividing net income (loss) attributable to common shareholders by the weighted average shares outstanding during the period, without consideration of common stock equivalents. Diluted net income (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 income (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 income (loss) per share because their effect would be anti-dilutive as described in the next paragraph, therefore, basic and diluted net income (loss) per share were the same for all periods presented. See Note 13 for the further discussion of the Company's Share Lending Agreement.

In accordance with ASC 260, the control number for determining whether including potential common shares in the diluted earning per share, or EPS, computation would be antidilutive should be income from continuing operations. As a result, if there is a loss from continuing operations, diluted EPS would be computed in the same manner as basic EPS is computed, even if the entity has net income after adjusting for a discontinued operation. The following potentially dilutive securities as of December 31, 2022, 2021, and 2020, have been excluded from the computations of diluted weighted average shares outstanding for the years then ended as they would have been anti-dilutive:

	December 31,		
	2022	2021	2020
Options	15,201,276	12,260,187	11,255,896
Restricted stock units	697,815	468,481	1,727,712
Warrants	—	121,888	133,264
Total	<u>15,899,091</u>	<u>12,850,556</u>	<u>13,116,872</u>

In addition, the Company's Convertible Notes convert at an exercise price of approximately \$17.05 per share of common stock, representing approximately 2,542,420 shares at December 31, 2022 and 11,732,440 shares at both December 31, 2021 and 2020. The shares underlying the Convertible Notes were considered for the dilutive calculation but were excluded in all years presented as their effect is antidilutive. See Note 11 for further discussion of the Convertible Notes.

Segment Information

The Company's chief operating decision maker ("CODM") regularly reviews disaggregated financial information for various operating segments. The financial information regularly reviewed by the CODM consists of (i) Biopharmaceuticals and (ii) Exemplar, each an operating segment which were also determined to be reportable segments. The Biopharmaceuticals reportable segment is primarily comprised of the Company's legal entities of PGEN Therapeutics and ActoBio. See Note 1 for a description of PGEN Therapeutics, ActoBio and Exemplar. Corporate expenses, which are not allocated to the segments and are managed at a consolidated level, include costs associated with general and administrative functions, including the Company's

finance, accounting, legal, human resources, information technology, corporate communication, and investor relations functions. Corporate expenses exclude interest expense, depreciation and amortization, gain or loss on disposals of assets, stock-based compensation expense, loss on settlement agreement, and equity in net loss of affiliates and include unrealized and realized gains and losses on the Company's securities portfolio. Note 18 for further discussion of the Company's segments.

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

In August 2020, the Financial Accounting Standards Board ("FASB") issued Accounting Standards Update ("ASU") 2020-06, Debt—Debt with Conversion and Other Options (Subtopic 470-20) and Derivatives and Hedging—Contracts in Entity's Own Equity (Subtopic 815-40)—Accounting for Convertible Instruments and Contracts in an Entity's Own Equity ("ASU 2020-06"). Under ASU 2020-06, the embedded conversion features are no longer separated from the host contract for convertible instruments with conversion features that are not required to be accounted for as derivatives under Topic 815, or that do not result in substantial premiums accounted for as paid-in capital. Consequently, a convertible debt instrument will be accounted for as a single liability measured at its amortized cost, as long as no other features require bifurcation and recognition as derivatives. The new guidance also requires the if-converted method to be applied for all convertible instruments.

We adopted ASU 2020-06 on January 1, 2022 using the modified retrospective transition method, which resulted in an increase to our reported long-term debt outstanding, net of current portion, of \$18,196, a decrease to our additional paid-in capital of \$36,868, and a corresponding cumulative-effect reduction to our opening accumulated deficit of \$18,672. Upon the adoption of ASU 2020-06, non-cash interest expense related to existing convertible debt outstanding at January 1, 2022 was expected to be reduced by approximately \$11,800 for the year ended December 31, 2022, and did not have an impact on our consolidated cash flows. The use of the if-converted method did not have an impact on our overall earnings per share calculation.

3. Discontinued Operations

Trans Ova

As part of the Company's strategic shift to becoming a primarily healthcare company, as discussed in Note 1, on August 18, 2022, the Company completed the sale of 100% of the issued and outstanding membership interests in its wholly-owned subsidiary, Trans Ova, to Spring Bidco LLC, a Delaware limited liability company for \$170,000 and up to \$10,000 in cash earn-out payments contingent upon the performance of Trans Ova in each of 2022 and 2023, \$5,000 for each year (the "Transaction"). The Company received \$162,306 in proceeds, net of certain transaction costs, on August 18, 2022, after giving effect to the preliminary closing purchase price adjustments. The final working capital adjustment of \$936 was received in the fourth quarter of 2022. In February 2023, Spring Bidco LLC notified the company that Trans Ova did not meet the financial measures required in 2022 in order to require the first \$5,000 earn-out payment. The Company has until March 15, 2023 to respond to Spring Bidco LLC.

The Company elected to account for the contingent consideration arrangement as a gain contingency in accordance with ASC 450, *Contingencies (Subtopic 450-30)*. Under this approach, the Company recognizes the contingent consideration receivable in earnings after the contingency is resolved. Accordingly, to determine the initial gain on the sale of Trans Ova, the Company did not include an amount related to the contingent consideration arrangement as part of the consideration received.

In connection with the Transaction, the Company, as of December 31, 2022, holds restricted cash of \$43,339, in a segregated account to be used for certain permitted purposes, including resolution of the Company's outstanding convertible notes as discussed further in Note 11. In addition, the Company is required to indemnify the Buyer for certain expenses incurred post close (related to covenants and certain additional specified liabilities including certain patent infringement lawsuits), if incurred, in amounts not to exceed \$5,750, which was recorded as a reduction of the gain on divestiture in the twelve months ended December 31, 2022, and is included in other accrued liabilities as of December 31, 2022. To date, the Company has not received an indemnification claim.

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The carrying values of the major classes of assets and liabilities included in assets and liabilities held for sale related to Trans Ova as of December 31, 2021 are as follows:

	December 31, 2021
Assets	
Cash and cash equivalents	\$ 6,497
Trade Receivables, net	19,491
Inventory	12,935
Other current assets	1,265
Property, plan and equipment, net	25,716
Intangible assets, net	1,824
Goodwill	16,594
Right-of-use assets	910
Other noncurrent assets	252
Total assets held for sale	<u>\$ 85,484</u>
Liabilities	
Accounts payable	\$ 2,293
Accrued compensation and benefits	3,367
Other accrued liabilities	3,778
Deferred revenue	2,952
Current portion of long-term debt	350
Other current liabilities	111
Long-term debt, net of current portion	2,867
Other long-term liabilities	805
Total liabilities held for sale or abandonment	<u>\$ 16,523</u>

The following table presents the financial results of discontinued operations related to TransOva through the date of disposition in 2022:

	Year Ended December 31,		
	2022	2021	2020
Product revenues	\$ 21,494	\$ 25,131	\$ 21,914
Service revenues	49,657	64,475	49,272
Total revenues	71,151	89,606	71,186
Cost of products	18,634	23,070	26,529
Cost of services	22,701	29,570	23,610
Research and development	2,348	2,208	2,216
Selling, general and administrative	15,215	22,128	19,010
Impairment of assets	—	—	106
Total operating expenses	58,898	76,976	71,471
Operating income (loss)	12,253	12,630	(285)
Other income, net	1,139	1,412	1,489
Equity in net loss of affiliates	—	—	(535)
Gain on divestiture	94,702	—	—
Income before income taxes	\$ 108,094	\$ 14,042	\$ 669
Income tax (expense) benefit	—	—	—
Income from discontinued operations	<u>\$ 108,094</u>	<u>\$ 14,042</u>	<u>\$ 669</u>

The following table presents the significant noncash items, purchases of property, plant and equipment, and proceeds from sales of assets for the discontinued operations related to Trans Ova that are included in the accompanying consolidated statements of cash flows:

	Year Ended December 31,		
	2022	2021	2020
Adjustments to reconcile net loss to net cash used in operating activities			
Depreciation and amortization	3,574	5,622	6,750
Impairment of assets	—	—	106
Loss on disposal of assets	421	561	4,325
Equity in net loss of affiliates	—	—	535
Provision for credit losses	944	1,128	899
Stock-based compensation expense	9	350	738
Cash flows from investing activities			
Proceeds from repayment of notes receivable	—	3,689	—
Purchases of property, plant and equipment	(3,529)	(4,694)	(6,365)
Proceeds from sales of assets	594	1,894	2,387

MBP Titan

As a result of market uncertainty driven by the COVID-19 pandemic and the state of the energy sector raising significant challenges for the strategic alternatives pursued by MBP Titan, beginning in the second quarter of 2020 and throughout the remainder of 2020, the Company suspended MBP Titan's operations, preserved certain of MBP Titan's intellectual property, terminated all of its personnel, and undertook steps to dispose of its other assets and obligations. The wind down of MBP Titan's activities was substantially completed by December 31, 2020, with the final disposition of certain property and equipment and the facility operating lease occurring in January 2021. This discontinuation of operations represented the continuation of a strategic shift to becoming primarily a healthcare company advancing technologies and products that address complex healthcare challenges that the Company commenced as part of the Transactions defined and discussed below. The assets, liabilities, and expenses related to the discontinued operations of MBP Titan are classified and presented as discontinued operations in the accompanying consolidated financial statements for all periods.

The January 2021 sale of property and equipment resulted in a gain on disposal of assets of \$464, which is included in income from discontinued operations in the accompanying consolidated statement of operations for the year ended December 31, 2021. In January 2021, the Company executed termination and recapture agreements with the landlord of the leased facility used in MBP Titan's operations, thereby relieving the Company of all of its obligations related to the facility that were originally due to expire in July 2025. This lease termination resulted in a gain of \$4,602, which is also included in income from discontinued operations in the accompanying consolidated statement of operations for the year ended December 31, 2021.

After the wind down of MBP Titan, certain assets and contractual obligations which were previously managed by MBP Titan continue to be managed at the Precigen corporate level. These remaining assets and contractual obligations include the Company's equity interest in and collaboration agreements with Intrexon Energy Partners, LLC ("Intrexon Energy Partners") and Intrexon Energy Partners II, LLC ("Intrexon Energy Partners II"), including the associated deferred revenue remaining under each collaboration agreement (Notes 4 and 5), as well as the associated intellectual property developed by MBP Titan to date. These assets, liabilities, and related historical revenue and equity losses are included in the Company's operating results from continuing operations in the accompanying consolidated financial statements for all periods presented as a result of the Company's continuing involvement.

The following table presents the financial results of discontinued operations related to MBP Titan:

	Year Ended December 31,	
	2021	2020
Operating (gains) expenses (1)	\$ (4,599)	\$ 40,692
Operating income (loss)	4,599	(40,692)
Income (loss) before income taxes	4,599	(40,692)
Income (loss) from discontinued operations	<u>\$ 4,599</u>	<u>\$ (40,692)</u>

(1) Includes an impairment charge of \$9,635 and an impairment charge on property, plant and equipment and ROU Assets of \$12,406 in 2020 in conjunction with the suspension of MBP Titan's operations discussed above.

The following table presents the significant noncash items, purchases of property, plant and equipment, and proceeds from sales of assets for the discontinued operations related to MBP Titan that are included in the accompanying consolidated statements of cash flows.

	Year Ended December 31,	
	2021	2020
Adjustments to reconcile net loss to net cash used in operating activities		
Depreciation and amortization	\$ —	2,474
Impairment of goodwill	—	9,635
Impairment of other noncurrent assets	—	12,406
(Gain) loss on disposal of assets, net	(464)	67
Stock-based compensation expense	—	(34)
Noncash gain on termination of leases	(4,602)	—
Cash flows from investing activities		
Purchases of property, plant and equipment	—	(88)
Proceeds from sales of assets	1,083	3,952

Transactions with TS Biotechnology Holdings, LLC and Darling Ingredients, Inc.

On January 1, 2020, the Company and TS Biotechnology Holdings, LLC ("TS Biotechnology"), a related party and an entity managed by Third Security, entered into a Stock and Asset Purchase Agreement pursuant to which the Company agreed to sell a majority of the Company's non-healthcare assets and operations to TS Biotechnology for \$53,000 and certain contingent payment rights (the "TS Biotechnology Sale"). The TS Biotechnology Sale closed on January 31, 2020. The assets and operations sold in the TS Biotechnology Sale included the following wholly owned subsidiaries, as well as certain equity securities that were directly related to the subsidiaries sold:

- Intrexon Produce Holdings, Inc., the parent company of two companies focused on the development and sale of non-browning apples, Okanagan Specialty Fruits, Inc. and Fruit Orchard Holdings, Inc.;
- Intrexon UK Holdings, Inc., the parent company of Oxitec Limited and its subsidiaries, which focused on biological insect solutions;
- ILH Holdings, Inc., a company focused on the production of certain fine chemicals focused primarily on microbial production of therapeutic compounds; and
- Blue Marble AgBio LLC which was formed in January 2020 and included certain agriculture biotechnology assets and operations that were previously an operating division within Precigen.

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Additionally, on January 2, 2020, the Company sold its equity interest in EnviroFlight, LLC ("EnviroFlight"), a JV with Darling Ingredients, Inc. ("Darling"), and related intellectual property rights to Darling for \$12,200 (the "EnviroFlight Sale"). Unless referenced separately, the TS Biotechnology Sale and the EnviroFlight Sale are collectively referred to as the "Transactions".

Upon the closing of the TS Biotechnology Sale in January 2020, the cumulative foreign currency translation losses totaling \$26,957 were released to earnings and included in loss from discontinued operations. See further discussion below regarding this out-of-period adjustment.

The transactions were approved by the Company's independent members of the board of directors in December 2019.

The following tables present the financial results of discontinued operations related to the Transactions for the year ended December 31, 2020.

	Year Ended December 31, 2020		
	TS Biotechnology Sale	EnviroFlight Sale	Total
Revenues (1)	\$ 1,294	\$ —	\$ 1,294
Operating expenses	896	—	896
Operating income	398	—	398
Gain on sale of discontinued operations	633	39	672
Loss on release of cumulative foreign currency translation adjustment	(26,957)	—	(26,957)
Other expense, net	(129)	—	(129)
Equity in net loss of affiliates	—	(38)	(38)
Income (loss) before income taxes	(26,055)	1	(26,054)
Income tax expense	(2)	—	(2)
Income (loss) from discontinued operations	<u>\$ (26,057)</u>	<u>\$ 1</u>	<u>\$ (26,056)</u>

(1) Includes revenue recognized from related parties of \$436.

The following table presents the significant noncash items, investments in EnviroFlight and purchases of property, plant and equipment for the discontinued operations for the Transactions that are included in the accompanying consolidated statements of cash flows.

	Year Ended December 31, 2020
Adjustments to reconcile net loss to net cash used in operating activities	
Depreciation and amortization	\$ —
Impairment of goodwill	—
Impairment of other noncurrent assets	—
Gain on sale of discontinued operations	(672)
Loss on release of cumulative foreign currency translation adjustment	26,957
Unrealized and realized depreciation on equity securities and preferred stock, net	106
Equity in net loss of EnviroFlight	38
Stock-based compensation expense	(1,346)
Deferred income taxes	—
Cash flows from investing activities	
Investments in EnviroFlight	—
Purchases of property, plant and equipment	(382)

Equity Method Investments

The Company accounted for its investment in EnviroFlight using the equity method of accounting.

Summarized financial data for EnviroFlight for the periods in which the Company held the equity method investment were not material.

Out-of-Period Adjustment

During the year ended December 31, 2020, the Company recorded an out-of-period adjustment of \$26,572 to loss from discontinued operations which relates to the effect of cumulative foreign translation losses associated with the entities sold in the TS Biotechnology Sale. This charge, which is entirely noncash, should have been recorded in the year ended December 31, 2019 as an additional impairment charge included in loss from discontinued operations. There was no impact to net loss from continuing operations, cash and short-term investments, cash flows, or Segment Adjusted EBITDA. The error also had no impact on the cash consideration received upon closing of the TS Biotechnology Sale nor the representations and warranties made by the Company in the transaction. The Company evaluated the effects of this out-of-period adjustment, both qualitatively and quantitatively, and concluded that this adjustment was not material to the Company's results of operations for the year ended December 31, 2020.

4. Investments in Joint Ventures

Intrexon Energy Partners

In 2014, the Company and certain investors (the "IEP Investors"), including an affiliate of Third Security, entered into a Limited Liability Company Agreement that governs the affairs and conduct of business of Intrexon Energy Partners, a JV formed to optimize and scale-up the Company's 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 for the production of certain fuels and lubricants, 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, Precigen 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, 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. Intrexon Energy Partners was governed by the Intrexon Energy Partners Board, which has five members. Prior to Precigen's purchase of certain membership interests from the IEP Investors in the third quarter of 2022 as discussed below and in Note 3, two members of the Intrexon Energy Partners Board were designated by the Company and three members were designated by a majority of the IEP Investors. Upon accumulating 87.5% of the membership interests owned by the IEP Investors in the third quarter of 2022, the Company obtained the right to designate all members of the Intrexon Energy Partners Board.

The Company's investment in Intrexon Energy Partners was \$(428) as of December 31, 2021, and is included in other accrued liabilities in the accompanying consolidated balance sheets, which represents the Company's equity in losses for contractually committed contributions to Intrexon Energy Partners.

See Notes 3 for additional discussion regarding the Company's investment in Intrexon Energy Partners.

Intrexon Energy Partners II

In 2015, the Company and certain investors (the "IEPII Investors"), including Harvest Intrexon Enterprise Fund I, LP ("Harvest"), entered into a Limited Liability Company Agreement that governs the affairs and conduct of business of Intrexon Energy Partners II, a JV 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%. Also in 2015, the owners of Intrexon Energy Partners II made a capital contribution of \$4,000, half of which was paid by the Company. Precigen 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, 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 was governed by the Intrexon Energy Partners II Board, which has five members. Prior to Precigen's purchase of the membership interests from the IEP II Investors in the third quarter of 2022, one member of the Intrexon Energy Partners II Board was designated by the Company and four members were designated by a majority of the IEP II Investors. Upon acquisition of all of the membership interests owned by the IEP II Investors in the third quarter of 2022 (the Company purchased the remaining 2.9% membership units in the fourth quarter of 2022), the Company obtained the right to designate all members of the Intrexon Energy Partners II Board.

The Company's investment in Intrexon Energy Partners II was \$(435) as of December 31, 2021, and is included in other accrued liabilities in the accompanying consolidated balance sheets, which represents the Company's equity in losses for contractually committed contributions to Intrexon Energy Partners II.

See Notes 5 for additional discussion regarding the Company's investment in Intrexon Energy Partners II.

Acquisition of Membership Interests in Intrexon Energy Partners and Intrexon Energy Partners II

On December 29, 2021, the Company received a letter from a group of investors in each of Intrexon Energy Partners and Intrexon Energy Partners II, referring certain issues to arbitration pursuant to the arbitration provisions of the Amended and Restated Limited Liability Company Agreements of Intrexon Energy Partners and Intrexon Energy Partners II (the "Arbitration Matters"). In July 2022, the arbitration panel ruled on the Arbitration Matters, and adopted the Company's proposed terms with respect to each of the Arbitration Matters and, pursuant to that ruling, the Company acquired the membership interests of the investors for an aggregate amount of approximately \$7,000 in cash.

The Company recorded the \$7,000 payment as a reduction of the revenue in 2022 (from deferred revenue – see Note 5) upon the Company obtaining control of Intrexon Energy Partners and Intrexon Energy Partners II. The fair value of the net assets of Intrexon Energy Partners and Intrexon Energy Partners II at the acquisition date is deemed to be substantially \$0. The Company liquidated and dissolved Intrexon Energy Partners and Intrexon Energy Partners II during the fourth quarter of 2022, which did not have a material impact on the financial statements of the Company.

5. Collaboration and Licensing Revenue

The Company's collaborations and licensing agreements may 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. Options to acquire additional services are considered to determine if they constitute material rights. At contract inception, the transaction price is typically the upfront payment received and is allocated to the performance obligations. 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.

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 equity method investments, or other qualitative factors. Collaboration and licensing revenues generated from consolidated subsidiaries are eliminated in consolidation.

The following table summarizes 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, 2022, 2021, and 2020.

	Year Ended December 31,		
	2022	2021	2020
Alaunos Therapeutics, Inc.	\$ 100	\$ 100	\$ 200
Oragenics, Inc.	—	—	3,053
Intrexon Energy Partners, LLC	3,768	—	—
Intrexon Energy Partners II, LLC	10,793	—	—
Castle Creek Biosciences, Inc.	—	388	17,810
Other	—	18	145
Total (1)	<u>\$ 14,661</u>	<u>\$ 506</u>	<u>\$ 21,208</u>

(1) Collaboration and licensing revenues recognized for the years ended December 31, 2022, 2021, and 2020, include the recognition of \$14,561, \$397, and \$20,205, respectively, associated with upfront and milestone payments which were previously deferred.

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

Intrexon Energy Partners and Intrexon Energy Partners II Collaborations

In July 2022, the Company obtained control of both of Intrexon Energy Partners Board and Intrexon Energy Partners II Board (as discussed in Notes 3, and 4). Based on its assessment of the status of each collaboration and ultimate dissolution of Intrexon Energy Partners and Intrexon Energy Partners II, the Company determined that it was probable that no further performance obligations would occur under the respective collaboration agreements. Accordingly, the Company recognized the remaining balance of deferred revenue associated with Intrexon Energy Partners and Intrexon Energy Partners II, less the amounts paid to acquire the membership interests of the investors of \$7,000, for an aggregate amount of revenue recognized of approximately \$14,561.

Alaunos Collaborations

In 2018, the Company, through its wholly owned subsidiary PGEN Therapeutics, entered into a license agreement (the "Alaunos License Agreement") with Alaunos Therapeutics, Inc., formerly known as ZIOPHARM Oncology, Inc. ("Alaunos"), which terminated and replaced the terms of the ECC agreement entered into between the Company and Alaunos in 2011, including the amendments thereto. Contemporaneously with the execution of the license agreement, Alaunos ceased to be a related party. Pursuant to the terms of the Alaunos License Agreement, the Company granted Alaunos 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 certain rights as discussed in the 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 Alaunos 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. Alaunos will be solely responsible for all aspects of the research, development and commercialization of the exclusively licensed products for the treatment of cancer. Alaunos is required to use commercially reasonable efforts to develop and commercialize IL-12 Products, CD19 Products, and the TCR Products. The Company also granted Alaunos 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. Alaunos is responsible for all development costs associated with each of the licensed products, other than Gorilla IL-12 Products. Alaunos and the Company will share the development costs and operating profits for Gorilla IL-12 Products, with Alaunos responsible for 80% of the development costs and receiving 80% of the operating profits, as defined in the Alaunos License Agreement, and the Company responsible for the remaining 20% of the development costs and receiving 20% of the operating profits, except that Alaunos 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").

Under the Alaunos License Agreement, Alaunos will pay the Company an annual license fee of \$100 and, in 2019, reimbursed the Company \$1,000 with respect to historical Gorilla IL-12 Products. Alaunos will make milestone payments, payable upon the initiation of later stage clinical trials and upon the approval of exclusively licensed programs in various jurisdictions, totaling up to an additional \$52,500 for each of four exclusively licensed programs, up to an aggregate of \$210,000. In addition, Alaunos 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. Alaunos 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. Alaunos will also pay the Company 20% of any sublicensing income received by Alaunos relating to the licensed products.

Under the Alaunos License Agreement, the Company reacquired rights previously held by Alaunos 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 Alaunos. The Company will pay Alaunos 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 also received from Alaunos reimbursement of costs incurred to transition the necessary knowledge and materials for Alaunos programs for a period of one year from the effective date (the "Transition Services").

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 Alaunos for such products. The Alaunos 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, Alaunos may terminate the Alaunos License Agreement on a country-by-country or program-by-program basis following written notice to the Company, and either party may terminate the Alaunos License Agreement following notice of a material breach.

Replacement of the original ECC with the Alaunos License Agreement was a contract modification under ASC 606 that represented the termination of the original agreement and the creation of a new agreement as the remaining rights, obligations, and services to be exchanged, which were limited to the Transition Services, were distinct from those under the ECC. The Company determined the new agreement had a transaction price of \$1,855, the majority of which related to a portion of the deferred revenue remaining from the original ECC. The annual license payments, excluding the first such payment which was included in the transaction price, 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 Alaunos products developed pursuant to the Alaunos License Agreement will be recognized when the sales occur. The Company recognized payments from Transition Services as those services were performed and recognized the transaction price as it performed the Transition Services required under the Alaunos License Agreement.

The Company determined that the Gorilla Program represented a separate collaboration agreement under the scope of ASC 808, *Collaborative Arrangements*, ("ASC 808") and was not included in the accounting for the Alaunos License Agreement under ASC 606. The development costs and operating profits from the Gorilla Program will be recognized in accordance with ASC 808.

Oragenics Collaboration

In 2015, the Company entered into an ECC with Oragenics, a related party at the time. Pursuant to the ECC, 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 the ECC, the Company received a technology access fee of a \$5,000 convertible promissory note, which was subsequently converted to shares of Oragenics' common stock. These shares were sold in the TS Biotechnology Sale in 2020 (Note 3). 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 Oragenics during the ECC. In July 2020, the Company and Oragenics mutually agreed to terminate the ECC, and accordingly, the Company recognized the remaining balance of deferred revenue associated with the ECC totaling \$2,823. Following the termination of the ECC, Oragenics is no longer a related party.

Exotech Bio, AD Skincare, and Thrive Agrobiotics Collaborations

In 2015 and 2016, the Company entered into three separate ECCs with Exotech Bio, Inc. ("Exotech Bio"), AD Skincare, Inc. ("AD Skincare"), and Thrive Agrobiotics, Inc. ("Thrive Agrobiotics"), all affiliates of Harvest and related parties at the time. The total upfront consideration received for the three collaborations was \$11,000, which consisted of equity interests in each of these entities. The Company also received reimbursements for research and development services provided pursuant to the

ECCs. In conjunction with a settlement agreement with Harvest (Note 17), these ECCs were terminated in December 2020, and the previously licensed technology rights reverted to the Company pursuant to the ECCs. The Company wrote off the remaining balance of deferred revenue associated with these ECCs in 2020 totaling \$6,993 as an offset to the loss recognized on the settlement agreement.

Castle Creek Collaborations

In October 2012, the Company entered into an ECC (the "2012 Castle Creek ECC") with Castle Creek Biosciences, Inc. ("Castle Creek", formerly known as Fibrocell Science, Inc.). Castle Creek was a publicly traded cell and gene therapy company focused on diseases affecting the skin and connective tissue and a related party until it was acquired in December 2019 by Castle Creek Pharmaceutical Holdings, Inc. ("Castle Creek Pharmaceutical"), a privately held company focused on developing medicine for rare genetic disorders. Pursuant to the 2012 Castle Creek ECC, at the transaction effective date, Castle Creek received a license to the Company's technology platform to develop and commercialize genetically modified and non-genetically modified autologous fibroblasts and autologous dermal cells in the United States of America. The Company received (i) upfront consideration upon execution of the ECC in the form of Castle Creek common stock valued at \$7,576, (ii) shares of Castle Creek common stock valued at \$7,612 as consideration for a 2013 amendment which expanded the field of use defined in the agreement, (iii) sublicensing fees totaling \$3,750 in the form of cash in 2019, and (iv) reimbursements for research and development services performed during the ECC.

In March 2020, the Company and Castle Creek terminated the 2012 Castle Creek ECC by mutual agreement ("Termination Agreement") with the parties agreeing that the two drug product candidates pursuant to the ECC would be treated as "Retained Products" under the terms of the 2012 Castle Creek ECC. One of these product candidates is D-Fi (debcoemagene autoficel), formerly designated FCX-007, for the treatment of recessive dystrophic epidermolysis bullosa, or RDEB. Castle Creek retains a license under the 2012 Castle Creek ECC to continue to develop and commercialize the Retained Products within the field of use of the 2012 Castle Creek ECC for so long as Castle Creek continues to pursue such development and commercialization. No further licenses to the Company's technology are provided to Castle Creek. On a quarterly basis, Castle Creek will pay the Company royalties of 7% of net sales up to \$25,000 and 14% of net sales above \$25,000 on each Retained Product, as defined in the agreement. Additionally, the Termination Agreement provided for the Company to perform certain drug product manufacturing activities related to the Retained Products. The Termination Agreement was accounted for as a new contract, and the remaining deferred revenue from the 2012 Castle Creek ECC was recognized prospectively through 2021 as the manufacturing activities were performed.

In December 2015, the Company entered into a second ECC with Castle Creek (the "2015 Castle Creek ECC"). Pursuant to the ECC, at the transaction effective date, Castle Creek 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. In February 2020, the Company and Castle Creek mutually agreed to terminate the 2015 Castle Creek ECC, and accordingly, the Company recognized the remaining balance of deferred revenue associated with the 2015 Castle Creek ECC totaling \$10,000 in 2020.

Deferred Revenue

Deferred revenue primarily consists of consideration received for the Company's collaboration and licensing agreements. The arrangements classified as long-term (of which \$0 and \$21,205 was related to agreements with Intrexon Energy Partners and Intrexon Energy Partners II as of December 31, 2022 and December 31, 2021, respectively) are not active while the respective counterparties evaluate the status of the project and its desired future development activities since the Company cannot reasonably estimate the amount of service to be performed over the next year. Deferred revenue consisted of the following:

	December 31,	
	2022	2021
Collaboration and licensing agreements	\$ 1,818	\$ 23,023
Prepaid product and service revenues	15	1,277
Other	10	213
Total	\$ 1,843	\$ 24,513
Current portion of deferred revenue	\$ 25	\$ 1,490
Long-term portion of deferred revenue	1,818	23,023
Total	\$ 1,843	\$ 24,513

6. Short-term and Long-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, 2022:

	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Aggregate Fair Value
United States government debt securities	\$ 51,755	\$ —	\$ (760)	\$ 50,995
Certificates of deposit	97	—	—	97
Total	\$ 51,852	\$ —	\$ (760)	\$ 51,092

The following table summarizes the amortized cost, gross unrealized gains and losses, and fair value of available-for-sale investments as of December 31, 2021:

	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Aggregate Fair Value
United States government debt securities	\$ 121,036	\$ —	\$ (331)	\$ 120,705
Certificates of deposit	97	—	—	97
Total	\$ 121,133	\$ —	\$ (331)	\$ 120,802

See Notes 2 and 7 for further discussion on the Company's method for determining the fair value of its assets.

The estimated fair value of available-for-sale investments classified by their contractual maturities as of December 31, 2022 was:

Due within one year	\$ 51,092
After one year through two years	—
Total	\$ 51,092

Changes in market interest rates and bond yields cause certain investments to fall below their cost basis, resulting in unrealized losses on investments.

7. Fair Value Measurements

The carrying amount of cash and cash equivalents, receivables, 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 as of December 31, 2022:

	Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	December 31, 2022
Assets				
United States government debt securities	\$ —	\$ 50,995	\$ —	\$ 50,995
Certificates of deposit	—	97	—	97
Total	<u>\$ —</u>	<u>\$ 51,092</u>	<u>\$ —</u>	<u>\$ 51,092</u>

The following table presents the placement in the fair value hierarchy of financial assets that are measured at fair value on a recurring basis as of December 31, 2021:

	Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	December 31, 2021
Assets				
United States government debt securities	\$ —	\$ 120,705	\$ —	\$ 120,705
Certificates of deposit	—	97	—	97
Total	<u>\$ —</u>	<u>\$ 120,802</u>	<u>\$ —</u>	<u>\$ 120,802</u>

The method used to estimate the fair value of the Level 2 short-term and long-term debt 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.

Liabilities

The carrying values of the Company's long-term debt, excluding the Convertible Notes, 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 11) was approximately \$43,000 and \$160,000 as of December 31, 2022 and 2021, respectively, and is based on the recent third-party trades of the instrument as of the balance sheet date. The fair value of the Convertible Notes is 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 on the accompanying consolidated balance sheets at amortized cost, which was \$43,219 and \$179,882 as of December 31, 2022 and 2021, respectively.

See Notes 9 and 10 for discussion of non-recurring fair value estimates used in calculating impairment charges recorded during the years ended December 31, 2022, 2021, and 2020.

8. Inventory

Inventory consists of the following:

	December 31,	
	2022	2021
Supplies, embryos and other production materials	\$ 15	\$ 23
MiniSwines	272	303
Total inventory	<u>\$ 287</u>	<u>\$ 326</u>

9. Property, Plant and Equipment, Net

Property, plant and equipment consist of the following:

	December 31,	
	2022	2021
Land and land improvements	\$ 164	\$ 164
Buildings and building improvements	2,592	2,592
Furniture and fixtures	457	434
Equipment	18,006	16,812
Leasehold improvements	4,333	3,366
Breeding stock	123	36
Computer hardware and software	4,562	4,823
Construction and other assets in progress	531	1,829
	<u>30,768</u>	<u>30,056</u>
Less: Accumulated depreciation and amortization	(23,439)	(21,457)
Property, plant and equipment, net	<u>\$ 7,329</u>	<u>\$ 8,599</u>

Depreciation expense was \$2,393, \$2,866, and \$3,049 for the years ended December 31, 2022, 2021, and 2020, respectively.

Recorded impairment losses of \$638, \$543 and \$814 for the years ended December 31, 2022, 2021, and 2020, respectively, are included in impairment of other noncurrent assets on the accompanying consolidated statement of operations and are primarily related to right-of-use assets at certain of the Company's leased locations.

10. Goodwill and Intangible Assets, Net

The changes in the carrying amount of goodwill for the years ended December 31, 2022 and 2021, are as follows:

	2022	2021
Beginning of year	\$ 37,554	\$ 37,769
Impairment	(482)	—
Foreign currency translation adjustments	(149)	(215)
End of year	<u>\$ 36,923</u>	<u>\$ 37,554</u>

The Company had \$14,483 and \$14,001 of cumulative goodwill impairment losses as of December 31, 2022 and 2021,

The Company recorded \$482 of goodwill impairment related to the total goodwill assigned to one reporting unit within the biopharmaceutical segment during the year ended December 31, 2022.

See Note 18 for information regarding goodwill by reportable segment.

Intangible assets consist of the following as of December 31, 2022:

	Weighted Average Useful Life (Years)	Gross Carrying Amount	Accumulated Amortization	Net
Patents, developed technologies and know-how	16.4	\$ 80,892	\$ (36,437)	\$ 44,455
Customer relationships	3.0	1,600	(1,600)	—
Trademarks	5.0	200	(200)	—
Total		<u>\$ 82,692</u>	<u>\$ (38,237)</u>	<u>\$ 44,455</u>

Intangible assets consist of the following as of December 31, 2021:

	Gross Carrying Amount	Accumulated Amortization	Net
Patents, developed technologies and know-how	\$ 85,173	\$ (32,882)	\$ 52,291
Customer relationships	1,600	(1,600)	—
Trademarks	200	(200)	—
Total	<u>\$ 86,973</u>	<u>\$ (34,682)</u>	<u>\$ 52,291</u>

Amortization expense was \$4,798, \$5,273, and \$5,243 for the years ended December 31, 2022, 2021, and 2020, respectively. Estimated aggregate amortization expense for definite lived intangible assets is expected to be as follows:

2023	\$ 4,773
2024	4,773
2025	4,773
2026	4,773
2027	4,773
Thereafter	20,590
Total	<u>\$ 44,455</u>

211. Lines of Credit and Long-Term Debt

Lines of Credit

Exemplar has a \$2,500 revolving line of credit with American State Bank that matures on October 31, 2023. As of December 31, 2022, the line of credit bore interest at 7.00% per annum. As of December 31, 2022 and December 31, 2021, there was no outstanding balance.

Long-Term Debt

Long-term debt consists of the following:

	December 31,	
	2022	2021
Convertible debt	\$ 43,219	\$ 179,882
Other	—	52
Long-term debt	43,219	179,934
Less current portion	43,219	52
Long-term debt, less current portion	<u>\$ —</u>	<u>\$ 179,882</u>

Convertible Debt

Precigen Convertible Notes

In July 2018, Precigen 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 Precigen 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"). Precigen received net proceeds of \$193,958 after deducting underwriting discounts and offering expenses of \$6,042.

The Convertible Notes are senior unsecured obligations of Precigen 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 and are repayable in cash, unless earlier repurchased or converted. Upon conversion by the holders, the Convertible Notes are convertible into cash, shares of Precigen's common stock or a combination of cash and shares, at

Precigen's election. The initial conversion rate of the Convertible Notes is 58.6622 shares of Precigen 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, Precigen 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 ended on September 30, 2018, if the last reported sales price of Precigen'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;
- 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 Precigen'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, 2022. On or after April 1, 2023 until June 30, 2023, holders may convert their Convertible Notes at any time. The Convertible Notes do not allow Precigen to call the debt prior to the maturity date.

If Precigen undergoes a fundamental change, as defined in the Indenture, holders of the Convertible Notes may require Precigen 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 Precigen 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 Precigen'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, in the amount of \$143,723, and additional paid-in capital, the equity component, in the amount of \$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 the then current year domestic operating losses in the same amount.

As described in Note 2, the Company adopted ASU 2020-06 on January 1, 2022. Pursuant to ASU 2020-06, the equity components of the Convertible Notes separated from the debt components as required under the cash conversion model is required to be recombined into the Convertible Notes as a single instrument upon the adoption of ASU 2020-06. The Convertible Notes shall be accounted for as if the conversion option had not been separated. As the Company elected the modified retrospective approach, the difference between the accounting under the cash conversion model and new model after the adoption of ASU 2020-06 (i.e., the single debt instrument with no separation) was recorded as an adjustment on the adoption date (i.e., January 1, 2022) through accumulated deficit. Tax accounting consequences of the adoption also required the reversal of the previously reported deferred tax benefit on the date of adoption through accumulated deficit.

Adoption of ASU 2020-06 resulted in an increase to long-term debt outstanding, net of current portion, of \$18,196, a decrease to additional paid-in capital of \$36,868, and a decrease to accumulated deficit of \$18,672. Interest expense recognized on the convertible notes in future periods was expected to be reduced as a result of accounting for the convertible debt instrument as a single liability measured at its amortized cost.

As discussed in Note 3, in connection with the sale of Trans Ova in 2022, the Company transferred a total of \$200,000 into a segregated account to be used for certain permitted purposes, including resolution of the Company's outstanding Convertible Notes. During the year December 31, 2022 and subsequently, the Company executed open market purchases of a portion of the outstanding Convertible Notes. During the year ended December 31, 2022, the Company retired \$156,660 of principal balance

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from these purchases and recorded a gain on extinguishment of debt of approximately \$961, which was recorded within Other income (expense), net, within the consolidated statements of operations. As of December 31, 2022, \$43,339 of restricted cash remained in the segregated account noted above for permitted purposes including the resolution of the Company's outstanding Convertible Notes.

As of December 31, 2022, the outstanding principal balance on the Convertible Notes was \$43,340 and their carrying value was \$43,219. The effective interest rate on the Convertible Notes, including amortization of the long-term debt discount and debt issuance costs, is 4.25%. As of December 31, 2022, the unamortized debt discount and debt issuance costs related to the Convertible Notes totaled \$121.

Subsequent to year-end, the Company repurchased an additional \$15,460 of principal balance of Convertible Notes at a price of \$15,305, using restricted cash for the purchase.

The components of interest expense related to the Convertible Notes were as follows:

	Year Ended December 31,		
	2022	2021	2020
Cash interest expense	\$ 5,727	\$ 7,000	\$ 7,000
Non-cash interest expense	1,042	11,735	10,587
Total interest expense	<u>\$ 6,769</u>	<u>\$ 18,735</u>	<u>\$ 17,587</u>

Accrued interest of \$759 is included in other accrued liabilities on the accompanying consolidated balance sheet as of December 31, 2022.

See Note 2 for additional discussion regarding the Convertible Notes.

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. The ActoBio Notes, which accrued interest at 3.0% compounded annually ("accrued PIK interest"), matured in September 2020. The Company issued 6,293,402 shares of Precigen common stock upon conversion of the outstanding principal balance and accrued PIK interest at maturity. Interest expense was \$616 for the year ended December 31, 2020.

Future Maturities

Future maturities of long-term debt as of December 31, 2022 are as follows:

2023	\$ 43,340
2024	—
2025	—
2026	—
2027	—
Thereafter	—
Total	<u>\$ 43,340</u>

12. Income Taxes

The components of loss from continuing operations before income taxes are presented below:

	Year Ended December 31,		
	2022	2021	2020
Domestic	\$ (76,572)	\$ (107,582)	\$ (97,982)
Foreign	(3,394)	(3,385)	(6,542)
Loss from continuing operations before income taxes	<u>\$ (79,966)</u>	<u>\$ (110,967)</u>	<u>\$ (104,524)</u>

The components of income tax benefit from continuing operations are presented below:

	Year Ended December 31,		
	2022	2021	2020
United States federal income taxes:			
Deferred	\$ 37	\$ 37	\$ 37
Foreign income taxes:			
Current	(39)	7	74
Deferred	(198)	(215)	(204)
State income taxes:			
Deferred	11	11	11
Income tax benefit from continuing operations	<u>\$ (189)</u>	<u>\$ (160)</u>	<u>\$ (82)</u>

Income tax benefit from continuing operations for the years ended December 31, 2022, 2021, and 2020 differed from amounts computed by applying the applicable United States federal corporate income tax rate of 21% to loss before income taxes as a result of the following:

	2022	2021	2020
Computed statutory income tax benefit from continuing operations	\$ (16,793)	\$ (23,303)	\$ (21,950)
State and provincial income tax benefit, net of federal income taxes	(2,884)	(4,670)	(5,199)
Nondeductible stock based compensation	179	832	5,709
Nondeductible officer compensation	263	1,459	728
Impairment of goodwill	101	—	—
Nondeductible equity investment loss	3,093	—	—
Research and development tax incentives	(991)	(958)	(524)
Acquisition and internal restructuring transaction costs	—	—	—
United States-foreign rate differential	18	(32)	(21)
Other, net	533	(46)	(306)
	<u>(16,481)</u>	<u>(26,718)</u>	<u>(21,563)</u>
Change in valuation allowance for deferred tax assets	16,292	26,558	21,481
Total income tax benefit from continuing operations	<u>\$ (189)</u>	<u>\$ (160)</u>	<u>\$ (82)</u>

The tax effects of temporary differences that comprise the deferred tax assets and liabilities included in continuing operations as of December 31, 2022 and 2021, are as follows:

	<u>2022</u>	<u>2021</u>
Deferred tax assets		
Allowance for doubtful accounts	\$ 53	\$ 1,506
Inventory	—	370
Equity securities and investments in affiliates	258	570
Property, plant and equipment	284	—
Intangible assets	69,807	80,540
Accrued liabilities	3,219	3,090
Lease liabilities	2,182	2,839
Stock-based compensation	17,106	15,227
Deferred revenue	474	7,300
Capitalized research and development cost	16,318	—
Research and development tax credits	12,160	11,168
Net operating, capital loss, and interest expense carryforwards	288,397	301,791
Total deferred tax assets	410,258	424,401
Less: (Valuation allowance)	401,086	408,396
Net deferred tax assets	9,172	16,005
Deferred tax liabilities		
Property, plant and equipment	—	250
Right-of-use assets	2,071	2,735
Foreign intangible asset	9,364	10,861
Long-term debt	—	4,698
Total deferred tax liabilities	11,435	18,544
Net deferred tax liabilities included in continuing operations	<u>\$ (2,263)</u>	<u>\$ (2,539)</u>

Activity within the valuation allowance for deferred tax assets included in continuing operations during the years ended December 31, 2022, 2021, and 2020 was as follows:

	<u>2022</u>	<u>2021</u>	<u>2020</u>
Valuation allowance at beginning of year	\$ 408,396	\$ 387,348	\$ 349,008
Increase (decrease) in valuation allowance as a result of			
Deconsolidation of AquaBounty	—	—	—
Establishment of deferred taxes for subsidiaries included in discontinued operations	—	—	—
Current year continuing operations	16,292	26,558	21,481
Discontinued operations treated as asset sales	(27,909)	(3,626)	7,805
Discontinued operations related to MBP Titan	—	(1,186)	8,019
Adoption of ASU 2020-06	4,698	—	—
Foreign currency translation adjustment	(391)	(698)	1,035
Valuation allowance at end of year	<u>\$ 401,086</u>	<u>\$ 408,396</u>	<u>\$ 387,348</u>

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.

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, 2022, all such limited losses applicable to Precigen, other than losses inherited via acquisition, have been fully utilized. As of December 31, 2022, approximately \$41,400 of the Company's domestic net operating losses were inherited via acquisition and are limited based on the value of the target at the time of the transaction.

As of December 31, 2022, the Company has net operating loss carryforwards for United States federal income tax purposes of approximately \$819,100 available to offset future taxable income, including approximately \$604,200 generated after 2017, United States capital loss carryforwards of approximately \$212,500, and federal and state research and development tax credits of approximately \$12,100, prior to consideration of annual limitations that may be imposed under Section 382. Net operating loss carryforwards generated prior to 2018 began to expire in 2022, and capital loss carryforwards will expire if unutilized beginning in 2024. As of December 31, 2022, the Company's foreign subsidiaries have foreign loss carryforwards of approximately \$71,000, most of which do not expire.

As of December 31, 2022, the Company's direct foreign subsidiaries included in continuing operations had accumulated deficits of approximately \$26,184. 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 and its subsidiaries do not have material unrecognized tax benefits as of December 31, 2022. 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 and capital losses and research and development tax credits.

13. Shareholders' Equity

Issuances of Precigen Common Stock

In January 2021, the Company closed a public offering of 17,250,000 shares of its common stock, resulting in net proceeds of \$121,045, after deducting underwriting discounts and capitalizable offering expenses.

Concurrent with entering into the TS Biotechnology Sale on January 1, 2020 (Note 3), the Company also entered into a subscription agreement with TS Biotechnology pursuant to which TS Biotechnology purchased 5,972,696 shares of the Company's common stock for \$35,000 on January 31, 2020.

In January 2023, the Company closed a public offering of 43,962,640 shares of its common stock, resulting in net proceeds of approximately \$73,000, after deducting underwriting discounts, fees, and other underwriting expenses. Of the 43,962,640 shares issued, 11,517,712 shares were purchased by related parties and their affiliates.

See Notes 11 and 17 for discussion regarding additional issuances of Precigen common stock.

Share Lending Agreement

Concurrently with the offering of the Convertible Notes (Note 11), Precigen entered into a share lending agreement (the "Share Lending Agreement") with J.P. Morgan Securities LLC (the "Share Borrower") pursuant to which Precigen 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 Precigen 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 Share Borrower maintains collateral in the form of cash or certain permitted non-cash collateral with a market value at least equal to the market value of the Borrowed Shares as security for the obligation of the Share Borrower to return the Borrowed Shares when required by the terms above. 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"). Precigen did not receive any proceeds from the sale of the Borrowed Shares to the public or any lending fees from the Share Lending Agreement. 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 Precigen shareholders unless the Share Borrower defaults on the Share Lending Agreement.

At-the-Market Sales Agreement

On August 9, 2022, the Company entered into a Controlled Equity Offering Sales Agreement (the “Sales Agreement”) with Cantor Fitzgerald & Co. (the “Agent”), pursuant to which the Company may issue and sell from time to time shares of the Company’s common stock, no par value per share (the “Shares”), through the Agent. The offering and sale of up to \$100,000 of the Shares has been registered under the Securities Act of 1933. The Company has no obligation to sell any of the Shares under the Sales Agreement, and may at any time suspend or terminate the offering of its common stock pursuant to the Sales Agreement upon notice and subject to other conditions. The Company intends to use the proceeds of any sales to fund the development of clinical and preclinical product candidates and for working capital and other general corporate purposes.

No shares were sold in connection with the Sales Agreement during the year ended December 31, 2022.

Components of Accumulated Other Comprehensive Income (Loss)

The components of accumulated other comprehensive income (loss) are as follows:

	December 31,	
	2022	2021
Unrealized gain (loss) on investments	\$ (760)	\$ (331)
Income (loss) on foreign currency translation adjustments	(2,728)	534
Total accumulated other comprehensive income (loss)	<u>\$ (3,488)</u>	<u>\$ 203</u>

See Note 3 for further discussion of the release of cumulative losses on foreign currency translation adjustments upon the closing of the TS Biotechnology Sale.

14. Share-Based Payments

The Company measures the fair value of stock options and RSUs issued to employees and nonemployees as of the grant date for recognition of 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:

	Year Ended December 31,		
	2022	2021	2020
Cost of products and services	\$ 110	\$ 161	\$ 66
Research and development	2,188	2,706	611
Selling, general and administrative	7,899	10,687	18,331
Discontinued operations	9	350	(642)
Total	<u>\$ 10,206</u>	<u>\$ 13,904</u>	<u>\$ 18,366</u>

Precigen Stock Option Plans

In April 2008, Precigen adopted the 2008 Equity Incentive Plan (the "2008 Plan") for employees and nonemployees pursuant to which Precigen'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, 2022, there were 14,843 stock options outstanding under the 2008 Plan.

Precigen adopted the 2013 Plan for employees and nonemployees pursuant to which Precigen'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, 2022, there were 37,000,000

shares authorized for issuance under the 2013 Plan, of which 13,288,225 stock options and 82,055 RSUs were outstanding and 12,949,460 shares were available for grant.

In April 2019, Precigen adopted the 2019 Incentive Plan for Non-Employee Service Providers (the "2019 Plan"), which became effective upon shareholder approval in June 2019. The 2019 Plan permits the grant of share-based awards, including stock options, restricted stock awards, and RSUs, to non-employee service providers, including board members. As of December 31, 2022, there were 12,000,000 shares authorized for issuance under the 2019 Plan, of which 1,898,208 stock options and 615,760 RSUs were outstanding and 7,243,025 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, 2019	9,022,282	\$ 21.94	6.10
Granted	5,693,498	10.03	
Exercised	(30,061)	(3.88)	
Forfeited	(976,324)	(15.47)	
Expired	(2,453,499)	26.53	
Balances at December 31, 2020	11,255,896	15.53	7.25
Granted	2,058,820	7.59	
Exercised	(127,883)	(4.75)	
Forfeited	(305,293)	(7.02)	
Expired	(621,353)	(24.61)	
Balances at December 31, 2021	12,260,187	14.06	6.79
Granted	4,451,890	2.22	
Exercised	(375)	(2.28)	
Forfeited	(567,179)	(5.19)	
Expired	(943,247)	(22.32)	
Balances at December 31, 2022	15,201,276	10.41	6.87
Exercisable at December 31, 2022	8,559,359	13.58	5.75

Total unrecognized compensation costs related to unvested awards as of December 31, 2022 were \$12,709 and are expected to be recognized over a weighted-average period of approximately 2.29 years.

The weighted average grant date fair value of options granted during 2022, 2021, and 2020 was \$1.65, \$5.57, and \$2.98, respectively. The aggregate intrinsic value of options exercised during 2022, 2021, and 2020 was \$0, \$225, and \$51, 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 Precigen's common stock for those shares where the exercise price was lower than the fair value of Precigen's common stock on the date of exercise.

The following table summarizes additional information about stock options outstanding as of December 31, 2022:

Range of Exercise Prices	Options Outstanding				Options Exercisable			
	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
\$ 1.22 — \$ 2.33	4,944,982	\$ 2.17	8.85	\$ 7,630	1,602,732	\$ 2.02	8.21	\$ 2,708
\$ 2.53 — \$ 8.17	3,903,425	6.39	7.52	73	2,170,946	6.14	7.19	16
\$ 8.20 — \$ 17.85	3,601,175	14.45	6.78	—	2,033,987	14.33	6.60	—
\$ 18.19 — \$ 45.11	2,626,227	24.65	2.55	—	2,626,227	24.65	2.55	—
\$ 45.69	125,467	45.69	2.08	—	125,467	45.69	2.08	—
	<u>15,201,276</u>	<u>\$ 10.41</u>	<u>6.87</u>	<u>\$ 7,703</u>	<u>8,559,359</u>	<u>\$ 13.58</u>	<u>5.75</u>	<u>\$ 2,724</u>

The following table summarizes additional information about stock options outstanding as of December 31, 2021:

Range of Exercise Prices	Options Outstanding				Options Exercisable			
	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
\$ 1.55 — \$ 5.95	3,290,348	\$ 4.64	8.18	\$ 1,329	2,031,348	\$ 4.15	7.98	\$ 1,327
\$ 6.01 — \$ 11.90	3,568,102	9.69	8.46	—	833,104	9.79	7.90	—
\$ 12.01 — \$ 20.94	3,068,340	18.59	6.09	—	1,880,991	19.16	4.93	—
\$ 21.13 — \$ 45.69	2,332,393	28.06	3.22	—	2,332,393	28.06	3.22	—
\$ 47.35 — \$ 47.35	1,004	47.35	3.51	—	1,004	47.35	3.51	—
	<u>12,260,187</u>	<u>\$ 14.06</u>	<u>6.79</u>	<u>\$ 1,329</u>	<u>7,078,840</u>	<u>\$ 16.69</u>	<u>5.59</u>	<u>\$ 1,327</u>

RSU activity was as follows:

	Number of Restricted Stock Units	Weighted Average Grant Date Fair Value	Weighted Average Remaining Contractual Term (Years)
Balances at December 31, 2019	1,781,982	\$ 8.71	1.24
Granted	3,157,390	3.09	
Vested	(2,802,593)	(3.99)	
Forfeited	(409,067)	(8.59)	
Balances at December 31, 2020	1,727,712	6.11	0.42
Granted	462,019	7.87	
Vested	(1,624,013)	(5.76)	
Forfeited	(97,237)	(8.96)	
Balances at December 31, 2021	468,481	8.47	0.33
Granted	1,387,831	2.12	
Vested	(1,125,785)	4.29	
Forfeited	(32,712)	7.26	
Balances at December 31, 2022	<u>697,815</u>	2.66	0.13

Total unrecognized compensation costs related to unvested RSU awards as of December 31, 2022 were \$193 and are expected to be recognized over a weighted-average period of approximately 0.13 years.

Precigen currently uses authorized and unissued shares to satisfy share award exercises.

The Company's Executive Chairman ("Executive Chairman"), who previously served as an employee and executive officer until September 24, 2020, received a base salary of \$200 per month through March 31, 2020, payable in fully-vested shares of Precigen common stock with such shares subject to a three-year lock-up on resale.

In September 2020, the Company's board of directors, upon the recommendation of the compensation committee of the board, approved a new compensation arrangement for the Executive Chairman consisting of (i) an annual retainer of \$100 payable in cash or, at the Executive Chairman's election, shares of Precigen common stock; (ii) an annual grant of fully vested stock options having a grant date fair value of \$250; and (iii) an annual grant of RSUs having a grant date fair value of \$250 vesting over one year. The new compensation arrangement began in calendar year 2021 and was prorated for the nine months of 2020 not covered by the Executive Chairman's previous compensation arrangement discussed above. Expense associated with the arrangements above is included in selling, general, and administrative expenses in the Company's consolidated statements of operations and totaled \$813, \$680, and \$767 for the years ended December 31, 2022, 2021, and 2020, respectively.

15. Operating Leases

The Company leases certain facilities and equipment under operating leases. Leases with a lease term of twelve months or less are considered short-term leases and are not recorded on the balance sheet, and expense for these leases is recognized over the term of the lease. All other leases have remaining terms of less than one year to eight years, some of which may include options to extend the lease and some of which may include options to terminate the lease within one year. The Company uses judgment to determine whether it is reasonably possible to extend the lease beyond the initial term or terminate before the initial term ends and the length of the possible extension or early termination. The leases are renewable at the option of the Company and do not contain residual value guarantees, covenants, or other restrictions.

The components of lease costs were as follows:

	Year Ended December 31,		
	2022	2021	2020
Operating lease costs	\$ 2,444	\$ 2,872	\$ 3,239
Short-term lease costs	170	252	311
Variable lease costs	422	800	842
Lease costs	\$ 3,036	\$ 3,924	\$ 4,392

As of December 31, 2022, maturities of lease liabilities, excluding short-term and variable leases, for continuing operations were as follows:

2023	\$ 2,074
2024	1,882
2025	1,851
2026	1,508
2027	1,246
Thereafter	3,108
Total	11,669
Present value adjustment	(3,468)
Total	\$ 8,201
Current portion of operating lease liabilities	\$ 1,209
Long-term portion of operating lease liabilities	6,992
Total	\$ 8,201

Other information related to operating leases in continuing operations was as follows:

	December 31,	
	2022	2021
Weighted average remaining lease term (years)	6.09	6.72
Weighted average discount rate	11.05 %	10.94 %

	Year Ended December 31,		
	2022	2021	2020
Supplemental disclosure of cash flow information			
Cash paid for operating lease liabilities	\$ 2,493	\$ 3,199	\$ 3,679
Operating lease right-of-use assets obtained in exchange for new lease liabilities (includes new leases or modifications of existing leases)	466	4,868	112

During the year ended December 31, 2022, 2021 and 2020 the company recorded impairment charges related to right-of-use assets. See Note 9 for further discussion.

16. Commitments and Contingencies

Contingencies

In October 2020, several shareholder class action lawsuits were filed in the United States District Court for the Northern District of California on behalf of certain purchasers of the Company's common stock. The complaints name as defendants the Company and certain of its current and former officers. The plaintiffs' claims challenged disclosures about the MBP program from May 10, 2017 to March 1, 2019. In March 2021, the court granted an order consolidating the claims and, in April 2021, appointed a lead plaintiff and lead counsel in the case, captioned *In re Precigen Securities Litigation*, Case No. 5:20-cv-06936-BLF (N.D. Cal.). On May 18, 2021, the lead plaintiff filed an Amended Class Action Complaint. On August 2, 2021, the defendants moved to dismiss the Amended Class Action Complaint. On September 27, 2021, the lead plaintiff filed a Second Amended Class Action Complaint in lieu of a response to the defendants' motion to dismiss. On November 3, 2021, the defendants moved to dismiss the Second Amended Class Action Complaint and on May 31, 2022, the court granted the defendants' motion to dismiss the Second Amended Class Action Complaint with leave to amend. On August 1, 2022, the lead plaintiff filed a Third Amended Class Action Complaint.

On August 2, 2022 the Court granted the parties' request to conduct a private mediation session to explore potential resolution of the action. On November 17, 2022, at the conclusion of the mediation session, the parties executed a memorandum of understanding that agreed in principle to resolve the claims asserted in the securities class action. The settlement provides for a payment to the plaintiff class of \$13,000. The proposed settlement requires final negotiation of the terms of settlement and both preliminary and final approval by the court. Should the court not approve the proposed settlement or if the proposed settlement otherwise does not become final, the parties will be returned to their litigation postures prior to the agreement in principle to settle. In the event that the litigation resumes, the defendants intend to move to dismiss the plaintiff's Third Amended Class Action Complaint. During the quarter ended December 31, 2022, we recorded an accrual of \$13,000 in Other accrued liabilities and separately recognized an insurance receivable asset of \$12,411 within Receivables, other, on the consolidated balance sheet, in addition to expense of \$589 recorded in selling, general and administrative on the consolidated statement of operations, the amount remaining on its self-insured retention/deductible.

In December 2020, a derivative shareholder action, captioned *Edward D. Wright, derivatively on behalf of Precigen, Inc. F/K/A Intrexon Corp. v. Alvarez et al*, was filed in the Circuit Court for Fairfax County in Virginia on behalf of Precigen, Inc. asserting similar claims under state law against Precigen's current directors and certain officers. The plaintiff seeks damages, forfeiture of benefits received by defendants, and an award of reasonable attorneys' fees and costs. The case was stayed by an order entered on June 14, 2021. On September 24, 2021, an individual shareholder filed a lawsuit in the Circuit Court for Henrico County styled *Kent v. Precigen, Inc.*, Case CL21-6349. The *Kent* action demands inspection of certain books and records of the Company pursuant to Virginia statutory and common law. On April 1, 2022, the court denied the demurrer and referred the matter to a hearing on the merits. The Company intends to defend the lawsuits vigorously; however, there can be no assurances regarding the ultimate outcome of these lawsuits.

In the course of its business, the Company is involved in litigation or legal matters, including governmental investigations.

Such matters may result in adverse judgments, unfavorable settlements, or concessions by the Company, or adverse regulatory action, any of which could harm the Company's business or operations. Moreover, 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, 2022, 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 Executive Chairman is also the Senior Managing Director and Chairman of Third Security and owns 100% of the equity interests of Third Security. Through December 2019, the Company was party to a Services Agreement ("Services Agreement") with Third Security pursuant to which Third Security provided the Company with certain professional, legal, financial, administrative, and other support services necessary to support the Company and its Executive Chairman. Following the expiration of the Services Agreement, the Company entered into a new agreement with Third Security under which the Company reimburses Third Security for certain tax-related services performed by Third Security as requested by the Company which expired on December 31, 2021. As the Company evaluated its alternatives, it continued to utilize these services on a limited basis under the terms of the original agreement. The Company also reimburses Third Security for certain out-of-pocket expenses incurred on the Company's behalf prior to and after the expiration of the Services Agreement under a separate agreement. The total expenses incurred by the Company under these arrangements were \$25, \$100, and \$159 for the years ended December 31, 2022, 2021, and 2020, respectively.

See also Note 14 regarding compensation arrangements between the Company and its Executive Chairman.

Through November 2021, the Company also subleased certain administrative offices to Third Security. The significant terms of the lease mirrored the terms of the Company's lease with the landlord, and the Company recorded sublease income of \$0, \$75, and \$83 for the years ended December 31, 2022, 2021, and 2020, respectively. During November 2021, in conjunction with the early termination of the sublease, Third Security paid the Company \$143 which represented a pro rata portion of the early termination fee the Company paid the landlord.

See Notes 1, 3, and 13 regarding additional transactions with affiliates of Third Security.

Other Related Parties

In December 2020, the Company entered into an agreement with Harvest to resolve matters related to the parties' contractual and equity relationships and to settle all claims made in connection with the notice of arbitration noted above. Pursuant to the settlement agreement, the Company issued 2,117,264 shares of its common stock to Harvest valued at \$18,103 in consideration of (i) the termination of the ECC agreements with Thrive Agrobiotics, Exotech Bio, and AD Skincare, which the Company had \$6,993 of deferred revenue remaining related to these ECCs prior to the settlement agreement; (ii) the return of the Company's ownership interest in these Harvest start-up entities that had a total value of \$326 prior to the settlement agreement; (iii) the commitment of Harvest (which is still ongoing) to take reasonable commercial efforts to transfer to the Company its membership interests in Intrexon Energy Partners II; and (iv) mutual irrevocable and unconditional releases of claims. The Company wrote off the investment balances and netted the deferred revenue balances associated with the eliminated service obligation against the consideration paid, resulting in a loss on the settlement agreement of \$11,436, which is included in selling, general and administrative expenses in the accompanying consolidated statement of operations for the year ended December 31, 2020. Outstanding receivables from these Harvest start-up entities related to research and development services performed by the Company under the ECC agreements, which had been fully reserved in 2019, were also forgiven as part of the settlement agreement and written off by the Company. Following the settlement agreement, these Harvest start-up entities are no longer related parties.

18. Segments

The Company's CODM assesses the operating performance of and allocates resources for several operating segments using Segment Adjusted EBITDA. Management believes this financial metric is a key indicator of operating results since it excludes noncash revenues and expenses that are not reflective of the underlying business performance of an individual enterprise. The Company defines Segment Adjusted EBITDA as net income (loss) before (i) interest expense, (ii) income tax expense or benefit, (iii) depreciation and amortization, (iv) stock-based compensation expense, (v) loss on settlement agreements where

noncash consideration is paid, (vi) adjustments for accrued bonuses paid in equity awards, (vii) gain or loss on disposals of assets, (viii) loss on impairment of goodwill and other noncurrent assets, (ix) equity in net loss of affiliates, and (x) recognition of previously deferred revenue associated with upfront and milestone payments as well as cash outflows from capital expenditures and investments in affiliates but includes proceeds from the sale of assets in the period sold. Segment Adjusted EBITDA excludes the gain or loss on disposals of assets and include proceeds from the sale of assets in the period sold.

Because the Company uses Segment Adjusted EBITDA as its primary measure of segment performance, it has included this measure in its discussion of segment operating results. The Company has also disclosed revenues from external customers and intersegment revenues for each reportable segment. Corporate expenses are not allocated to the segments and are managed at a consolidated level. The CODM does not use total assets by segment to evaluate segment performance or allocate resources, and accordingly, these amounts are not required to be disclosed. The Company's segment presentation excludes amounts related to the businesses included in the Transactions, the operations of MBP Titan and Trans Ova which are reported as discontinued operations (Note 3).

For the year ended December 31, 2022, the Company's reportable segments were (i) Biopharmaceuticals and (ii) Exemplar. These identified reportable segments met the quantitative thresholds to be reported separately for the year ended December 31, 2022. See Note 2 for a description of Biopharmaceuticals and Exemplar.

Segment Adjusted EBITDA by reportable segment was as follows:

	Year Ended December 31,		
	2022	2021	2020
Biopharmaceuticals	\$ (45,039)	\$ (45,754)	\$ (35,378)
Exemplar	4,997	6,898	4,004
Segment Adjusted EBITDA for operating segments	<u>\$ (40,042)</u>	<u>\$ (38,856)</u>	<u>\$ (31,374)</u>

The table below reconciles Segment Adjusted EBITDA for reportable segments to consolidated net loss from continuing operations before income taxes:

	Year Ended December 31,		
	2022	2021	2020
Segment Adjusted EBITDA for reportable segments	\$ (40,042)	\$ (38,856)	\$ (31,374)
All Other Segment Adjusted EBITDA		—	—
Remove cash paid for capital expenditures, net of proceeds from sale of assets, and cash paid for investments in affiliates	1,362	2,483	605
Add recognition of previously deferred revenue associated with upfront and milestone payments	16,007	2,034	25,005
Other expenses:			
Interest expense	(6,774)	(18,755)	(18,209)
Depreciation and amortization	(7,191)	(8,139)	(8,292)
Loss from disposals of assets		(53)	(50)
Impairment losses	(1,120)	(543)	(814)
Stock-based compensation expense	(10,197)	(13,554)	(19,008)
Adjustment related to accrued bonuses paid in equity awards	1,698	—	2,833
Equity in net loss of affiliates	861	(3)	(603)
Other	(105)	(19)	11
Unallocated corporate costs	(32,913)	(33,506)	(48,915)
Eliminations	(1,552)	(2,056)	(5,713)
Consolidated loss from continuing operations before income taxes	<u>\$ (79,966)</u>	<u>\$ (110,967)</u>	<u>\$ (104,524)</u>

Revenues by reportable segment were as follows:

	Year Ended December 31, 2022		
	Biopharmaceuticals	Exemplar	Total
Revenues from external customers	\$ 14,894	\$ 12,015	\$ 26,909
Intersegment revenues	1,446	—	1,446
Total segment revenues	\$ 16,340	\$ 12,015	\$ 28,355

	Year Ended December 31, 2021		
	Biopharmaceuticals	Exemplar	Total
Revenues from external customers	\$ 922	\$ 13,345	\$ 14,267
Intersegment revenues	1,637	—	1,637
Total segment revenues	\$ 2,559	\$ 13,345	\$ 15,904

	Year Ended December 31, 2020		
	Biopharmaceuticals	Exemplar	Total
Revenues from external customers	\$ 21,780	\$ 10,158	\$ 31,938
Intersegment revenues	4,797	—	4,797
Total segment revenues	\$ 26,577	\$ 10,158	\$ 36,735

The table below reconciles total segment revenues from reportable segments to total consolidated revenues:

	Year Ended December 31,		
	2022	2021	2020
Total segment revenues from reportable segments	\$ 28,355	\$ 15,904	\$ 36,735
Other revenues, including from other operating segments	—	—	54
Elimination of intersegment revenues	(1,446)	(1,637)	(4,797)
Total consolidated revenues	\$ 26,909	\$ 14,267	\$ 31,992

For the years ended December 31, 2022, 2021, and 2020, 59.6%, 61.5%, and 51.9% of total Exemplar segment revenue was attributable to one customer, respectively. The Company recognized revenues derived in foreign countries totaling \$233, \$378, and \$595 for the years ended December 31, 2022, 2021, and 2020, respectively.

Goodwill by reportable segment was as follows:

	Biopharmaceuticals	Exemplar	Total
Goodwill			
Balances at December 31, 2020	\$ 17,693	\$ 20,076	\$ 37,769
Foreign currency translation adjustments	(215)	—	(215)
Balances at December 31, 2021	17,478	20,076	37,554
Foreign currency translation adjustments	(149)	—	(149)
Impairments	(482)	—	(482)
Balances at December 31, 2022	\$ 16,847	\$ 20,076	\$ 36,923

As of December 31, 2022 and 2021, the Company had \$2,591 and \$4,463, respectively, of long-lived assets in foreign countries.

19. 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 \$564, \$388, and \$397 for the years ended December 31, 2022, 2021, and 2020, respectively.