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

FORM 10-K

(Mark One)

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

For the fiscal year ended September 30, 2023

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: 001-38720

Twist Bioscience Corporation

(Exact Name of Registrant as Specified in its Charter)

Delaware	**46-2058888**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**

681 Gateway Blvd, South San Francisco, CA 94080
(Address of principal executive offices and zip code)

(800) 719-0671
(Registrant's telephone number, including area code)

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	**TWST**	**The Nasdaq Global Select Market**

Securities Registered Pursuant to Section 12(g) of the Act: None

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

Indicate by check mark if the Registrant is not required to file reports pursuant to Section 13 or 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. (Check one):

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

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

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

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

As of March 31, 2023, the last business day of the registrant's most recently completed second fiscal quarter, the aggregate market value of shares of common stock held by non-affiliates of the registrant was approximately $833 million based upon the closing sale price on the Nasdaq Global Select Market reported for such date.

The number of shares of the Registrant's common stock outstanding as of November 17, 2023, was 57,673,781.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Registrant's definitive proxy statement to be filed in connection with its 2023 Annual Meeting of Stockholders are incorporated by reference into Part III of this Form 10-K.

TWIST BIOSCIENCE CORPORATION
ANNUAL REPORT ON FORM 10-K
FOR THE FISCAL YEAR ENDED SEPTEMBER 30, 2023

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Forward-looking statements

This Annual Report on Form 10-K for the fiscal year ended September 30, 2023, or Form 10-K, contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Securities Exchange Act of 1934, as amended, or the Exchange Act. These statements relate to, among other matters, plans for product development and licensing to third parties, plans and timeframe for the commercial development of DNA data storage capabilities, expectations regarding market penetration, anticipated customer conversions to our products, plans to expand in the international markets, identification and development of potential antibody candidates for the treatment of COVID-19 and other diseases, and the anticipated timeframe for remediating the material weakness in internal control over financial reporting. Forward-looking statements are also identified by the words "believe," "will," "may," "estimate," "continue," "anticipate," "intend," "should," "plan," "expect," "predict," "could," "potentially" and variations of such words and similar expressions. You should not rely upon forward-looking statements as predictions of future events. Such statements are based on management's expectations as of the date of this filing and involve many risks and uncertainties that could cause our actual results, events or circumstances to differ materially from those expressed or implied in our forward-looking statements. Such risks and uncertainties include:

- our ability to increase our revenue and our revenue growth rate;
- our ability to accurately estimate capital requirements and our needs for additional financing; our estimates of the size of our market opportunities;
- our ability to increase DNA production, reduce turnaround times and drive cost reductions for our customers;
- our ability to effectively manage our growth;
- our ability to successfully enter new markets and manage our international expansion;
- our ability to protect our intellectual property, including our proprietary DNA synthesis platform;
- costs associated with defending intellectual property infringement and other claims;
- the effects of increased competition in our business;
- our ability to keep pace with changes in technology and our competitors;
- our ability to successfully identify, evaluate and manage any future acquisitions of businesses, solutions or technologies;
- the success of our marketing efforts;
- a significant disruption in, or breach in security of our information technology systems and resultant interruptions in service and any related impact on our reputation;
- our ability to attract and retain qualified employees and key personnel;
- the effects of natural or man-made catastrophic events such as the COVID-19 pandemic;
- the effectiveness of our internal controls;
- changes in government regulation affecting our business;
- uncertainty as to economic and market conditions and the impact of adverse economic conditions; and
- other risk factors included under the section titled "Risk factors."

You should not rely upon forward-looking statements as predictions of future events. Such statements are based on management's expectations as of the date of this filing and involve many risks and uncertainties that could cause our actual results, events or circumstances to differ materially from those expressed or implied in our forward-looking statements.

Readers are urged to carefully review and consider all of the information in this Form 10-K and in other documents we file from time to time with the Securities and Exchange Commission, or SEC. We undertake no obligation to update any forward-looking statements made in this Form 10-K to reflect events or circumstances after the date of this filing or to reflect new information or the occurrence of unanticipated events, except as required by law. We may not actually achieve the plans, intentions or expectations disclosed in our forward-looking statements. Our forward-looking statements do not reflect the potential impact of any future acquisitions, mergers, dispositions, joint ventures or investments we may make.

When we use the terms "Twist," "Twist Bioscience," the "Company," "we," "us" or "our" in this report, we are referring to Twist Bioscience Corporation and its consolidated subsidiaries unless the context requires otherwise. Sequence space and the Twist logo are trademarks of Twist Bioscience Corporation. All other company and product names may be trademarks of the respective companies with which they are associated.

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PART I

Item 1. *Business*

At Twist Bioscience Corporation, we work in service of our customers who are changing the world for the better. In fields such as health care, food/agriculture, industrial chemicals/materials, academic research and data storage, by using our products, our customers are developing ways to better lives and improve the sustainability of the planet. We believe Twist Bioscience is uniquely positioned to help accelerate their efforts and the faster our customers succeed, the better for all of us.

We have developed a disruptive DNA synthesis platform to industrialize the engineering of biology that provides DNA for a wide range of uses and markets. The core of our platform is a proprietary technology that pioneers a new method of manufacturing synthetic DNA by "writing" DNA on a silicon chip. We have miniaturized traditional chemical DNA synthesis reactions to write over one million short pieces of DNA on each silicon chip, approximately the size of a large mobile phone, reducing by 99.8% the amount of chemicals we estimate would be used per gene as compared to plate-based synthesis. We have combined our silicon-based DNA writing technology with proprietary software, scalable commercial infrastructure and an e-commerce platform to create an integrated technology platform that enables us to achieve high levels of quality, precision, automation, and manufacturing throughput at a significantly lower cost than our competitors.

We have applied our unique technology to manufacture a broad range of synthetic DNA-based products, including synthetic genes, tools for next generation sequencing, or NGS, sample preparation, and antibody libraries for drug discovery and development, all designed to enable our customers to conduct research more efficiently and effectively. Leveraging our same platform, we have expanded our footprint beyond DNA synthesis to manufacture synthetic RNA as well as antibody proteins to disrupt and innovate within larger market opportunities, in addition to discovery partnerships for biologic drugs and developing completely new applications for synthetic DNA, such as digital data storage. We sell our products to a global customer base of approximately 3,450 customers across a broad range of industries.

We believe our products enable a broad range of applications that may ultimately improve health and the sustainability of the planet across multiple industries, including:

- healthcare for the identification, prevention, diagnosis and treatment of disease (antibody discovery and optimization technology);
- chemicals/materials for cost-effective and sustainable production of new and existing specialty chemicals and materials, such as spider silk, nylon, rubber, fragrances, food flavors and food additives;
- food/agriculture for more effective and sustainable crop production;
- academic research for a broad range of education and discovery applications; and
- technology for potential use as an alternative long-term data storage medium.

Background

We currently generate revenue through our synthetic biology and NGS tools product lines as well as biopharma services for antibody discovery, optimization and development. In addition, we are leveraging our platform to expand our portfolio to include other products and address additional market opportunities, including vertical market opportunities in digital data storage.

As part of our synthetic biology continuum offering, we have commercialized a custom DNA library solution which we believe can be leveraged to facilitate other proprietary tools to provide an end-to-end solution in biologics drug discovery and early development, from target to investigational new drug, or IND, application, adding value as a partner to biotechnology and pharmaceutical companies. We are also leveraging this capability for our internal antibody discovery efforts.

In fiscal year 2023, we served approximately 3,450 customers and reported $245.1 million in revenue, including $137.1 million in revenue from the healthcare sector, $59.3 million in revenue from the chemicals/materials sector, $45.8 million in revenue from the academic research sector and $2.8 million in revenue from the food/agriculture sector.

Our Markets

Synthetic Biology

Our synthetic biology products serve life sciences researchers across a variety of healthcare applications including drug discovery, disease detection, enzyme engineering, gene editing and basic academic research. In addition, our synthetic biology products are used for chemical and materials applications including development of synthetic spider silk, nylon, rubber, fragrances, flavors and food additives; for food and agricultural applications including improving crop traits such as adding vitamins or improving drought tolerance, and engineering bacteria to deliver nitrogen at the root of plants.

Synthetic DNA is the fundamental building block that allows researchers to engineer biology. Researchers at a wide range of institutions can design synthetic DNA to regulate the production of proteins and other molecules to achieve a specific functional purpose. While synthetic DNA has been produced for more than 40 years, the complexities of biology and the production constraints inherent in legacy processes have historically limited the applications and market opportunities for DNA synthesis.

Next-Generation Sequencing

Our NGS tools play an integral role in the way our customers prepare their patient samples to be sequenced. NGS has transformed many markets in recent years by changing the landscape of diagnosing disease and disorders and offers a path to prevent or treat disease. Some of the markets impacted by NGS include oncology, reproductive health, food/agriculture, consumer genomics, infectious disease research and drug discovery. As NGS technology improves and the cost of sequencing declines, new emerging markets that were once considered impractical, such as population-scale sequencing, liquid biopsy (a test that detects multiple types of cancer from a single blood sample), minimal residual disease testing and single cell sequencing, have become major areas of interest and investment.

Historically, a significant constraint in many NGS applications has been the high cost and long turnaround time of oligonucleotide production. Highly accurate and reproducible oligonucleotide production is required to produce high quality target enrichment data. Traditionally, the lack of options for oligonucleotide production forced researchers to choose between using less precise methods or reducing the number of samples in their study.

The ability of the Twist DNA synthesis platform to precisely manufacture target enrichment probes at large scale has dramatically increased the types of projects that can now be addressed using NGS technologies. Our platform has unlocked new applications, improved data quality, and dramatically expanded the types of scientific questions that can be answered using NGS. In addition, the speed of our DNA synthesis platform enables customers to quickly deploy NGS technologies to applications where the time to answer is critical.

Our Platform

We developed the Twist Bioscience DNA synthesis platform to address the limitations of throughput, scalability, and cost inherent in legacy DNA synthesis methods. Our platform stems from extensive analyses and improvements to the existing gene synthesis and assembly workflows. Our core technologies combine expertise in silicon, software, fluidics, chemistry, and motion and vision control to miniaturize thousands of parallel chemical reactions on silicon and write thousands of strands of DNA in parallel.

Enzymatic Synthesis

Several companies are pursuing an emerging gene synthesis process that uses enzymatic chemistry rather than phosphoramidite chemistry. While the promise of enzymatic synthesis to deliver longer genes in a shorter timeframe provides excitement for the industry, this technology has not yet been proven to be scalable or commercially viable. We have developed our own, differentiated approach for enzymatic synthesis that we believe is scalable and commercially viable that we expect to implement for our enterprise DNA data storage solution.

Our Products

We have developed multiple products derived from synthetic DNA and our versatile DNA synthesis technology. Our current offering consists of two primary product lines, synthetic biology tools and NGS tools, that address different needs of our customers across a variety of applications. In addition to DNA, we now offer RNA and protein products.

Synthetic Biology Products

Synthetic genes and gene fragments

Synthetic genes are manufactured strands of DNA. Customers (biotech, pharma, industrial chemical, agricultural companies as well as academic labs) order our synthetic genes to conduct a wide range of research, including product development for therapeutics, diagnostics, chemicals/materials, food/agriculture, data storage as well as a multitude of emerging applications within academic research. Virtually all research and development of this type requires trial and error, and our customers require many variations of genes to find the DNA sequence that achieves their objectives.

We offer two primary categories of synthetic genes: clonal genes of perfect quality delivered to the customer in a vehicle called a vector; and genes that customers can place in their own vector, non-clonal genes or fragments. Within these two categories, customers can order different lengths of DNA depending on their required final gene construct. Customers can order longer genes or shorter genes and can stitch genes together to create longer or shorter constructs if desired.

Currently, we manufacture genes of up to 5,000 base pairs in length, yielding a clonally perfect piece of DNA that our customers can immediately use for their research. We offer non-clonal genes of up to 1,800 base pairs in length, which we believe addresses the vast majority of demand for non-clonal genes. We also offer larger quantities of DNA for customers who require it for their development efforts. Our error rate for gene fragments is 1:7500 nucleotides.

Oligonucleotide, or Oligo pools

Oligo pools, or high diversity collections of oligonucleotides, are utilized in many applications, including targeted NGS, CRISPR gene editing, mutagenesis experiments, DNA origami (the nanoscale folding of DNA to create two- and three-dimensional shapes at the nanoscale), DNA computing and data storage in DNA, among others. Our oligo pools are also used for high-throughput reporter assays that are used to study cell signaling pathways, gene regulation, and the structure of cell regulatory elements. For these applications, we provide customers with accurate and uniform synthetic oligos to precisely match their required designs.

We sell a diverse, customizable set of oligo pools, ranging from a few hundred oligos to over one million, and offer oligonucleotides of up to 300 nucleotides in length, with an error rate of 1:3000 nucleotides.

IgG proteins

Pairing the automation in our synthetic biology platform along with our expertise in antibody discovery, we introduced an immunoglobulin G (IgG) protein offering for our customers focused on the pursuit of drug discovery and development. In the process of antibody discovery, antibody fragments (Fab, small chain fragment variable (scFv) or VHH) must be reformatted to full IgGs. Leveraging our silicon-based synthesis platform, we provide customers with a high throughput IgG capability, removing this bottleneck from the antibody discovery process.

NGS tools

Building from our DNA synthesis platform, we have developed products to enable next-generation sequencing. In particular, we are focused on addressing the demand for better sample preparation products that improve sequencing workflow, increase sequencing accuracy, and reduce downstream sequencing costs. Using our silicon-based DNA synthesis platform, we are able to synthesize exact sequences of interest. In the target enrichment process, our synthetic DNA probes bind to the sequence of interest within the sample, acting like a magnet to isolate and physically extract the targeted segment of DNA.

Our NGS products are primarily used within diagnostic tests for various indications including rare disease, SARS-CoV-2 and cancer through liquid biopsy. In addition, customers use our NGS tools for population genetics research and biomarker discovery, translational research, microbiology and applied markets research. Our customers are primarily diagnostic companies and hospitals, research institutions, agricultural biotechnology companies, and consumer genetics companies conducting diagnostic tests for a wide range of applications.

We offer a wide variety of NGS tools for our customers including library preparation kits, human exome kits, fixed and custom panels as well as Alliance panels. Alliance panels are customer-curated content sold through Twist. In addition, we

offer specific workflow solutions including a methylation detection kit for cancer, rare and inherited disease study, as well as a fast hybridization solution (FastHyb), which allows researchers to go from sample to sequencer in a single day. In May 2023, we introduced a full RNA sequencing workflow, expanding our NGS product line to support RNA sequencing.

Synthetic viral controls, infectious disease research tools

Leveraging our DNA synthesis platform, we launched a new product line of synthetic viral controls in response to the rapid spread of COVID-19. We offer fully synthetic SARS-CoV-2 RNA reference sequences as positive controls for the development of both NGS and reverse transcription-polymerase chain reaction (RT-PCR) assays. Our SARS-CoV-2 controls are now included on the U.S. Food and Drug Administration website as reference materials. In May 2023, we introduced a full RNA sequencing workflow, expanding our NGS product line to support RNA sequencing. We expanded this product line to include synthetic monkeypox controls as well as a wide range of respiratory viral controls, including for influenzas, respiratory syncytial virus (RSV), rhinoviruses, SARS, MERS and coronaviruses. Importantly, these controls can be used to provide quality control for the development, verification and ongoing validation of diagnostic tests and allow researchers to develop tests safely and effectively, without working with live virus samples.

We also offer SARS-CoV-2 Research Panels, the Twist Respiratory Virus Panel and the Pan-Viral Research Panel, for the detection of disease in a research setting. All products can be used for environmental monitoring and surveillance testing, while also providing insight into the full sequence information to monitor viral evolution and strain origin.

Drug and Target Discovery Solutions

Precision DNA libraries

Our platform allows customers to customize every antibody sequence variation and construct a precise library systematically to target the entire region of interest. We can create single-site libraries in which we change a single amino acid (which is encoded by a group of three DNA nucleobases) within the sequence or single-site saturation libraries in which we change every amino acid within the sequence for a more comprehensive approach. We can also generate combinatorial libraries in which we introduce changes to multiple sites within the same gene in specific ratios and combinations. These libraries can be used for antibody engineering, affinity maturation, and humanization, which simplifies downstream screening and identifies more lead molecules. Our libraries are explicitly developed for a specific area of the genome or tailored to a specific disease, with antibody compounds evenly represented across all desired areas of the genome.

We have also developed a comprehensive antibody optimization solution to enable simultaneous optimization of multiple characteristics of a given antibody. We have developed custom software for the optimization of antibody hits, antibody compounds that meet pre-specified criteria for therapeutic development. We have added our high throughput and hyper-variant antibody library capabilities to create a comprehensive antibody optimization solution for potential partners. We are now using this solution to design, build and test hyper-variant, tightly controlled antibody libraries that follow the rules of the human repertoire and mitigate the pitfalls associated with traditional optimization methods. By following the rules of the human repertoire, which means including only DNA sequences known to occur in humans, we have created a “Library of Libraries” made up of many different individual libraries. These libraries are natural in composition and are expected to generate better drug development candidates. The libraries also have a large degree of synthetic variation, enabling simultaneous optimization of several antibody characteristics and the discovery of antibodies with high affinity and specificity to drug targets.

Partnerships with leading companies

We believe we have several avenues available to monetize our antibody discovery program. In general, partnerships for our antibody development platform require us to provide rapid, on-demand (high affinity) antibodies based on one or more targets provided by the customer.

Customers can design and purchase libraries, and we work with partners that bring us a target, to discover antibody leads against that target. These partnerships generate revenue in up-front fees, through the license of libraries and service revenue. In addition, many of our partnerships include success-based milestones for key clinical, regulatory and commercial achievements and/or royalties on any product sales resulting from our collaboration.

We used our proprietary antibody discovery technologies to identify antibody leads to several promising biological targets. While we have more than 20 identified, we prioritized the five most advanced antibody leads and intend to out-license these antibody leads in various stages of early discovery and development to experts in development and commercialization of biotechnology products. To date, we have generated antibody leads to multiple biological targets and these antibody leads are in various stages of early discovery and development.

As of September 30, 2023, we had signed 314 revenue-generating partnerships. Through these partnerships, we had 806 completed programs and 69 active programs with 68 of the programs including milestones and/or royalties as of September 30, 2023. Some of our partners include Bayer, Boehringer Ingelheim GmbH, Takeda Pharmaceutical Company Limited, Adicet Bio, Ono Pharmaceutical Ltd., Kyowa Kirin, Invetx, Inc., Astellas Pharma Inc. and Neogene Therapeutics, Inc. In addition, we collaborate with companies that bring complementary technologies to expand our opportunities and reach.

In vivo antibody discovery

Through our acquisition of Abveris in 2021, we added in vivo antibody discovery services to our capabilities. Our ability to induce an immune response in our proprietary, genetically engineered hyperimmune DiversimAb™ mouse strains allows us to generate antibodies against desired targets of interest previously unavailable through this discovery method. In addition, we have developed a specialized way to screen immune system B cells to enable the discovery of large, diverse sets of monoclonal antibodies (mAbs) for our partners.

Artificial intelligence/Machine learning for antibody discovery

We work with a variety of organizations and have an internal team focused on library design, lead selection and lead optimization as well as other activities to deliver antibody leads for our partners.

Our growth strategy

Our objective is to be the leading provider of synthetic DNA and DNA-based products worldwide and to leverage our platform to build a leadership position in other life sciences markets in which we have a competitive advantage. We intend to accomplish this objective by executing on the following:

- maintain and expand our position as the provider of choice for high-quality, affordable synthetic DNA, RNA and proteins to customers across multiple industries;
- become a leading supplier of NGS sample preparation products;
- conduct antibody therapeutic discovery and optimization for our current customers and future partners;
- continue to explore development of DNA as a digital data storage medium through internal research and government and industry partnerships; and
- expand our global presence.

Beyond these opportunities, we are working with industry partners to create new markets for our products by leveraging our platform.

Sales and marketing

We have built a versatile and scalable commercial platform that enables us to reach a diverse customer base that we estimate consists of over 100,000 synthetic DNA users, potential customers of our NGS tools products and partners who may use our services for antibody discovery. In order to address this diverse customer base, we employ a multi-channel strategy comprised of a direct sales force targeting synthetic DNA customers, a direct sales force focusing on the NGS market and an e-commerce platform that serves both commercial channels. Our sales force is focused on customer acquisition, support, and management across industries, and is highly trained on both the technical aspects of our platform and how synthetic DNA can be used in a wide range of industries. Our easy-to-use e-commerce platform allows customers to design, validate, and place on-demand orders of customized DNA online, and enables them to receive real-time customized quotes for their products and track their order status through the manufacturing and delivery process. This is a critical part of our strategy to address our large market and diverse customer base, as well as drive commercial productivity, enhance the customer experience, and promote loyalty. We target customers of our NGS products through a direct sales team focused on the NGS tools market, which is separate from our synthetic DNA sales force. Our direct NGS sales representatives are focused on supporting our early adopters and providing a high level of service in order to familiarize customers with our product offerings.

We sell our products through a worldwide commercial organization that includes direct sales personnel, commercial consultants in Europe and Asia, an e-commerce platform and distributors. As of September 30, 2023, we employed 215 employees and dedicated commercial consultants in sales, marketing and customer support.

Research and development

We are engaged in ongoing research and development efforts focused on enhancements to existing products and the development of new products. Currently, we are pursuing research and development projects with respect to the following:

- process development for highest quality oligos;
- optimizing our massively parallel fast turnaround time SynBio pipeline;
- silicon process and chemistry development for our data storage initiative;
- buildout of a massively parallel screening facility for our biopharma initiatives that allows us to screen thousands of antibodies per week;
- evaluate and implement AI applications to potentially optimize services for our customers;
- expansion of our product offerings for oligo, gene, synthetic controls, NGS library preparation and target enrichment, and DNA Libraries products; and,
- develop new products including mRNA and proteins.

Research and development activities are conducted in collaboration with manufacturing activities to help expedite new products from the development phase to manufacturing and to more quickly implement new process technologies. From time to time, our research and development efforts have included participation in technology collaborations with universities and research institutions.

As of September 30, 2023, we employed 203 people in our research and development team.

Patents and other intellectual property rights

Worldwide, we own or exclusively in-license over 50 issued or allowed patents and more than 400 pending patent applications as of September 30, 2023. In addition to these owned and exclusively licensed patents and pending patent applications, we also license patents on a non-exclusive and/or territory restricted basis. Our intellectual property portfolio includes important patents and patent applications directed to DNA synthesis, next generation sequencing, antibody libraries, and DNA data storage. Our policy is to file patent applications to protect technology, inventions and add improvements that are important to our business. Individual patent terms extend for varying periods of time, depending upon the date of filing of the patent application, the date of patent issuance, and the legal term of patents in the countries in which they are obtained.

Manufacturing and facilities

The production of our products is a highly complex and precise process. We currently manufacture all of our products and multiple sub-assemblies at our manufacturing facilities in South San Francisco, California and Wilsonville, Oregon. We consider our long-lived assets to be ready for their intended use when they are first capable of producing a unit of product that is saleable at which point depreciation of the asset commences. We also outsource some of our sub-assemblies to third party manufacturers. All of our products originate from synthetic DNA obtained from nanostructured clusters fabricated on our proprietary silicon technology platform. Due to its on-demand nature, the gene synthesis business requires manufacturing operations to be in operation 24 hours a day, seven days a week, 365 days per year. For synthetic genes, we have built a highly scalable gene production process with what we believe is industry-leading capacity to address the growing demand of scalable, high-quality, affordable synthetic genes. As of September 30, 2023, we employed 370 people in our manufacturing and operations team.

In addition to synthetic genes, we manufacture oligo pools. The pooling process has been fully automated through a mixture of custom proprietary and over-the-counter liquid handling equipment. We have the capacity to make many millions of high-quality oligos per day that can be used to make genes and gene fragments of various lengths, oligo pools of various sizes, DNA libraries and NGS tools products. We intend to increase our shipments to leverage our production capacity through our e-commerce platform, which we believe will expand both our market opportunity and our customer base.

The manufacturing process for our NGS tools is highly flexible given the efficiency of our production capability. We have automated the entire workflow using proprietary and over-the-counter laboratory equipment. We have built dedicated production capabilities for our NGS products.

ISO certification

Medical device manufacturers implement a Quality Management System (QMS) for medical devices to ensure that their products consistently meet regulatory requirements and customer expectations. Implementing a QMS for medical devices is crucial for ensuring patient safety, regulatory compliance, and the overall effectiveness and reliability of medical devices in the market. The international standard ISO 13485 is widely recognized and provides a framework for developing and maintaining a QMS specific to the medical device industry. We certified our QMS to the ISO 9001:2015 (Quality Management Systems—Requirements) standard and ISO 13485:2016 standard (Medical devices—Quality management systems—Requirements for regulatory purposes). ISO is a global network of national standards with over 18,000 standards for nearly every aspect of technology and business. ISO has standard bodies in 163 countries. ISO Surveillance Audits are carried out twice within a three-year period by the registrar (certification body) to ensure we maintain our system in compliance with ISO standards. Recertification is required every three years and we have been successfully recertified since obtaining our original ISO certification. Additionally, we were registered with the U.S. Food and Drug Administration ("FDA") as a manufacturer of "Reagents, 2019-novel coronavirus nucleic acid" under the FDA's Emergency Use Authorization.

In 2020, our QMS for manufacturing our NGS Target Enrichment Panels in our South San Francisco, and subsequently in 2023 our Wilsonville manufacturing facilities was certified to ISO 13485:2016.

Supply chain

We have historically purchased many of the components and raw materials used in our products from numerous suppliers worldwide. For reasons of quality assurance, sole source availability or cost effectiveness, certain components and raw materials used in the manufacture of our products are available only from one supplier. We have worked closely with our suppliers to develop contingency plans to assure continuity of supply while maintaining high quality and reliability, and in some cases, we have established long-term supply contracts with our suppliers. We qualify additional suppliers for key materials in an effort to ensure continuity of supply for our operations.

Competition

The synthetic biology industry is intensely competitive and is characterized by price competition, technological change, international competition, product turnaround time and manufacturing yield problems. The competitive factors in the market for our products include:

- price;
- product quality, reliability and accuracy;
- product offerings & complexity;
- turnaround time;
- breadth of product line;
- design and introduction of new products;
- market acceptance of our products and those of our customers;
- throughput and scale; and
- technical support and service.

We face competition from a broad range of providers of core synthetic biology products such as GenScript Biotech Corporation, DNA Script, Inc., GENEWIZ (owned by Azenta), Integrated DNA Technologies, Inc. (owned by Danaher Corporation), DNA 2.0 Inc. d/b/a/ ATUM, GeneArt (owned by Thermo Fisher Scientific Inc.), Eurofins Genomics LLC, Sigma-Aldrich Corporation (owned by Charles River Laboratories, Inc.) (an indirect wholly owned subsidiary of Merck & Company), Promega Corporation, OriGene Technologies, Inc., Blue Heron Biotech, LLC and others. Additionally, we compete with both large and emerging providers in the life sciences tools and diagnostics industries focused on sample preparation for NGS such as Thermo Fisher Scientific Inc., Illumina, Inc., Integrated DNA Technologies, Inc., and Agilent. In the antibody discovery market, we compete with clinical research organizations, such as Curia, GenScript, and Genovac (formerly part of Aldevron, LLC), and antibody discovery biotechnology companies, such as Fair Journey/Iontas, Adimab, Zymeworks, Distributed Bio (owned by Charles River), Ablexis, Specifica, OmniAb and AbCellera Biologics Inc. In the emerging field of DNA digital data storage, we compete with Catalog Technologies, Inc., Helixworks, Iridia, Inc., Roswell,

Seagate, Microsoft, GenScript, Molecular Assemblies, Ansa Biotechnologies, various academic institutions, and other emerging competitors.

Environmental, social, governance (ESG) and human capital

We are at the forefront of the synthetic biology revolution, and our products are increasingly being used to empower our customers, which consist of diagnostic, therapeutic and healthcare companies, agricultural biotech companies, chemical companies, academic institutions and government entities, around the world to address large societal challenges. All of our work supports our mission to provide synthetic DNA and DNA products to improve health and sustainability.

Our employees are a key factor in our ability to serve our customers. The ability to hire and retain highly skilled professionals remains key to our success in the marketplace. To attract, develop and motivate our employees, we offer a challenging work environment, ongoing skills development initiatives, attractive career advancement, opportunities and a culture that rewards entrepreneurial initiative and exceptional execution.

Guiding Principles and Business Ethics

Our guiding principles of grit, impact, service and trust serve as the foundation of our culture. Our guiding principles set the tone for how we work together, provide a framework for giving feedback and increase the power of our brand. Service is at the core of our business and our interactions with one another. We relentlessly focus on exceeding internal and external customer needs.

Diversity, equity, inclusion and belonging

Diversity is in our DNA all the way from the top of the organization down to the individual employee. Our board adopted a Board Diversity Statement in January 2022 to provide informed decisions on diversity, equity and inclusion. Our employees come from numerous countries and bring diversity to our workplace across many critical categories. We believe our company is stronger because of the variety of experiences and backgrounds our employees bring to their work every day. Among our employees, 61% identify as people of color.

We are committed to creating and maintaining a diverse, inclusive and safe work environment where our employees can bring their best selves to work each day. Our commitment to diversity extends through our recruitment, retention, learning and engagement and community partnerships. As part of our diversity, equity, inclusion and belonging strategy, we made an active decision to pursue opportunities for learning and engagement that bring people from different backgrounds together into conversation. We have initiated monthly Culture Conversations where we explore identities and systems of power using an intersectional lens each month. Past topics include: disability, LGBTQIA+, ageism, Latin identity, and more. Our objective is to appreciate each other as individuals with unique lived experiences, rather than define one another by a single trait such as race, sexual orientation or geographical location. To assess our efforts toward building a diverse workforce, we have included questions in our engagement survey to measure employee perception of inclusive culture.

In addition, we mandate training for all employees and managers to prevent workplace and sexual harassment. The course equips leaders and employees with the tools they need to identify and address unwelcome conduct in non-adversarial, respectful terms.

Recruiting

We believe that our employees are our most important asset. Beginning with the pre-recruitment process, we provide internship opportunities for students interested in biotechnology and the science, technology, engineering and mathematics (STEM) fields in both scientific and non-scientific departments. We engage with local communities to provide expert speakers sharing nontraditional career pathways for the biotechnology field. We partner with community colleges, historically black colleges and universities and Hispanic-focused institutions to build our brand within diverse communities as a source of diverse, high-quality candidates for every role with the goal of identifying the best possible candidate to fill open positions within the company.

We actively engage with future scientists through organizations including the International Genetically Engineered Machine (iGEM), a non-profit organization dedicated to furthering the field of synthetic biology. In addition, we have provided internships through the Gloucester Biotechnology Academy, a hands-on training program that prepares students for careers as entry-level technicians in cutting-edge laboratories; and Eastside Preparatory Academy, a high school dedicated to serving students historically underrepresented in higher education. We have engaged with several organizations in the Portland area including Portland Community College, Partnerships in Diversity, Oregon State University, Oregon Biosciences Association and others.

With an active program in place for our employees, we are striving to further support our female and underrepresented employees in advancing their careers while continuing to focus on hiring diverse talent, particularly at more senior positions.

Compensation and benefits, health and wellness

We strive to provide pay, comprehensive benefits and services that help meet the varying needs of our employees. Our generous total rewards package includes above-market pay; fully covered healthcare benefits for employees, with family member healthcare benefits covered at 90%; a health savings account that is fully funded for individuals and their families; approximately four weeks of paid vacation; a minimum of sixteen weeks of parental leave for all employees globally; flexible work schedules; and onsite services. In addition, we offer every full-time employee, both exempt and non-exempt, the benefit of equity ownership in the company through restricted stock units (RSU) grants and our employee stock purchase plan.

We have an expert-built educational platform to assist employee's fertility & family building needs with the help of treatment, fostering or adopting, plus dedicated resources for egg freezers, egg donation, LGBTQIA+ families, and solo parents.

We have increased our well-being benefits, by offering programs that help workers monitor and reduce their stress levels, providing apps to support sleep and relaxation. We have further addressed employees' emotional health and well-being by providing meditation sessions and using telehealth programs to offer mental health counseling.

COVID-19 employee safety and benefits

Many of our customers require our synthetic DNA products to provide critical tools for global health. Twist continues to take precautions to reduce the risk of virus exposure for all employees. We require all U.S. employees to be vaccinated. As a benefit for all employees, we provide COVID and flu vaccines for the employee and their family.

Employee health and safety

We remain steadfast in our commitment to promote the health and safety of our employees and have implemented a robust Injury and Illness Prevention Program (IIPP). We require annual workplace safety training to reinforce workplace safety procedures that may be useful in the event of emergency situations and to assist our employees in helping to prevent workplace accidents. Our Employee Safety Committee, which is comprised of numerous cross-departmental members, meets on a regular basis (at least quarterly) to review workplace safety and adherence to safety policies. As part of our efforts, all employees and managers complete workplace harassment and sexual harassment training that includes details on how to report any violation of these policies.

Conduct and ethics

Our Board of Directors adopted and regularly reviews the Code of Business Conduct and Ethics Policy (the "Code of Ethics"), which applies to all of our employees, directors and officers. We believe it is imperative that the board of directors and senior management strongly support a no-tolerance stance for workplace harassment, biases and unethical behavior. All employees are required to abide by, review and confirm compliance to the company's Code of Ethics, our Anti-Money Laundering Policy, our Anti-Corruption Policy, our Modern Slavery Act Statement and our Supplier Code of Conduct. We have established a reporting hotline and email address that enables employees to anonymously report any suspected violations of the Code of Ethics.

In addition, because synthetic DNA is considered to be a dual use technology, we invest substantial financial and human resources in biosecurity to help ensure that our products are used for responsible research. We endeavor to abide by all local, national and international regulations as well as trade compliance requirements and are an active member of the International Gene Synthesis Consortium and the Australia Group. We maintain an active relationship with the governing body for synthetic DNA within the U.S. Department of Homeland Security.

Growth and development

We invest significant financial and support resources to develop the talent we need to remain at the cutting edge of innovation to ensure Twist Bioscience is an employer of choice. Our performance management system is aimed at supporting our culture, maintaining consistency with our guiding principles and to focusing on continuous learning and development. Our success in the market depends on employees understanding and embracing how their job contributes to the company's overall strategy. We encourage cross team communication as well as integrated departmental communication. We believe this broadens our employee's skill set and provides opportunity for growth and advancement.

We invest in our next generation of leaders through a one-year leadership program for mid-level managers. In addition, we offer tuition reimbursement aimed at growth and career development.

We have made a significant investment in an online learning platform with on-demand, video-based content. Employees have the opportunity to refine or develop professional skills, learn new software, and explore as they plan their career growth. The platform also offers tremendous potential for managers and employees to create development plans as part of the performance review process.

Communications and engagement

We employ a variety of tools to facilitate open and direct communication including open forums with executives, employee surveys and engagement through focus groups, forums and committees. We endeavor to further refine our employee programs through our employee engagement survey as well as follow up quarterly pulse surveys. Based on the most recent survey conducted in March 2023 where 87% of our employees responded:

- 92% of employees understand Twist's mission
- 90% understand how they contribute to the mission of the company
- 93% understand how their goals contribute to Twist

We hold All Hands meetings twice per month as well as a monthly managers meeting for all people managers.

In October 2022, we were named a Great Place to Work for the second year in a row in the United States, and for the first time in China, Germany, Singapore and the UK.

Community engagement, social and relationship capital

We are endeavoring to develop relationships, give back to our communities and engage in corporate social responsibility and sustainability initiatives. We provide all employees with eight fully paid hours each year to give back to the community at an organization of their choice. We are working to engage with the local community organizations to provide volunteer opportunities for our employees. As we grow our employee base, we will extend our efforts in these areas.

Employee population

As of September 30, 2023, we had 919 employees, which includes our team of 17 dedicated commercial consultants. Of these employees, 203 were primarily engaged in research and development activities; 215 were primarily engaged in marketing, sales and customer support; 131 were primarily engaged in general and administrative activities; and 370 were primarily engaged in operations and manufacturing, dedicated to manufacturing our synthetic genes, oligo pools, NGS tools and DNA libraries. None of our employees is represented by a labor union, and we consider our employee relations to be good.

Board of Directors

Board Member	**Gender**
Nelson C. Chan	Male
Robert Chess	Male
Keith Crandell	Male
Jan Johannessen	Male
Xiaoying Mai	Female
Robert Ragusa	Male
Melissa A. Starovasnik	Female
Emily Leproust	Female
William Banyai	Male
Female	**33 %**
Male	**67 %**
Total	9

Executives

Executive Team Member	**Gender**
Emily Leproust	Female
Jim Thorburn	Male
Bill Banyai	Male
Angela Bitting	Female
Siyuan Chen	Male
Dennis Cho	Male
Patrick Finn	Male
Paula Green	Female
Tracey Mullen	Female
Nimisha Srivastava	Female
Aaron Sato	Male
Chet Gandhi	Male
Female	**42 %**
Male	**58 %**
Total	12

All Twisters (inclusive of executives)

Gender	Percent of all Twisters
Female	42 %
Non-Binary	0.4 %
Male	57 %
Total	919

Region	Percent of all Twisters
Americas	88 %
EMEA	7 %
APAC	5 %
Total	919

Environmental management

Many gene synthesis companies rely on oligonucleotide, or oligo (short pieces of DNA) synthesis on a plastic 96-well plate format. The 96-well plate allows researchers to create 96 oligos in parallel, one in each well. While this process can successfully achieve DNA synthesis, it requires high volumes of phosphoramidites, an expensive raw material, as well as other ancillary chemical reagents such as activator, wash, deblock, oxidizer and capping reagents, many of which are toxic and environmentally harmful. The reagent consumption levels vary depending on the DNA synthesizer and its setup.

At Twist, we developed an ultra-high-throughput DNA synthesis platform to address the limitations of throughput, scalability, and cost inherent in legacy DNA synthesis methods like that described above. With a footprint that is similar to the size of a 96-well plate that produces 96 oligos or 1 or 2 genes, we are able to produce approximately 1,000,000 oligos or 9,600 genes in parallel. Furthermore, we have calculated the carbon footprint of the Twist DNA synthesis method and compared it to the carbon footprint of the 96-well plate DNA synthesis process. The difference is significant. Twist Bioscience's emissions from manufacturing one gene is a minuscule 36 grams of CO_2e, while the 96-well plate process has a carbon footprint of 23 kilograms of CO_2e per gene.

With the Twist ultra-high-throughput DNA synthesizer, we believe we are able to achieve at least a 99.8% volume reduction (when compared to a standard manufacturer of oligos) in chemical consumption compared to legacy oligo synthesis. For the more expensive chemical reagents (e.g., phosphoramidite and activator reagents), we have achieved nearly a 1,000,000-fold volume reduction. This drastic volume reduction is achieved through various engineering breakthroughs, including using of inkjet printing to deliver phosphoramidites and activator reagents (10 picoliter per droplet), and the development of proprietary flow cell chambers and reagent recipes, among other proprietary developments.

In addition, the legacy oligo synthesis process often produces significantly more oligos than is typically required for most subsequent processes. In contrast, the Twist system includes a fully-integrated and miniaturized molecular biology workflow to assemble genes using nearly 100% of the oligos we produced, yielding nearly zero wasted synthesized oligos and reducing the usage of molecular biology reagents (e.g., polymerase and other enzymes, and dNTP).

Overall, Twist's process to synthesize DNA significantly reduces the quantity of chemicals used, overproduced product and waste, for a more sustainable production process.

Government regulation

Currently, our synthetic DNA products are intended for "Research Use Only" (RUO). We sell and promote these products for non-diagnostic and non-clinical purposes to academic institutions, life sciences and research laboratories, and biopharmaceutical and biotechnology companies who then integrate our products into their workflows for further commercialization. Our products are intended to be used as research tools that enable our customers to develop a wide spectrum of commercial products. However, in the future we may be subject to a variety of specialized regulatory requirements, including potential regulation by the U.S. Food and Drug Administration, or the FDA. For example, in December 2010, the Presidential Commission for the Study of Bioethical Issues recommended that the federal government oversee, but not regulate, synthetic biology research. The Presidential Commission also recommended that the federal government lead an ongoing review of developments in the synthetic biology field and that the federal government conduct a reasonable risk assessment before the field release of synthetic organisms.

Aside from certain labeling requirements, we believe that some of our products, as currently marketed, are largely unregulated by governmental bodies, including the FDA. As we expand our product development to include products for clinical applications, we may be subject to a variety of specialized regulatory requirements, including regulation by the FDA, any of which could have a material effect on the business. In the future, we expect to support compliance with current Good Manufacturing Practices (cGMP) and to support the required regulatory requirements as future regulations are updated by the FDA.

RUO is a term applicable to our target enrichment products for the next-generation sequencing (NGS) market and is applied to kits sold to this market segment. It is intended to restrict use of the kits to non-in vitro diagnostic purposes. Our NGS target enrichment and library preparation products are used in a more comprehensive workflow for next generation sequencing for research purposes only. In the future, we may develop this larger workflow as an in vitro diagnostic, for which we will obtain prior authorization from FDA or other applicable regulatory authorities before commercialization. We have also begun investigating how to support the In-Vitro Diagnostic Regulations (IVDR) of the European Union so that our regulated products could be available across Europe.

FDA

Pursuant to its authority under the Federal Food, Drug, and Cosmetic Act, or the FDC Act, the FDA has jurisdiction over medical devices. The FDA regulates, among other things, the research, testing, manufacturing, safety, labeling, storage, recordkeeping, premarket clearance or approval, marketing and promotion and sales and distribution of medical devices in the United States to ensure that medical products distributed domestically are not adulterated and are safe and effective for their intended uses. In addition, the FDA regulates the import and export of medical devices.

Medical device regulation in general

The FDC Act classifies medical devices into one of three categories based on the risks associated with the device and the level of control necessary to provide reasonable assurance of safety and effectiveness. Devices deemed by the FDA to pose the greatest risk, such as life-sustaining, life-supporting or implantable devices, or devices deemed not substantially equivalent to previously 510(k) cleared devices are generally categorized as Class III. These devices typically require submission and approval of a Premarket Approval Application, or PMA. However, FDA can reclassify or use "de novo classification" for a device that meets the FDC Act standards for a class II or III device, which still requires PMA approval. Devices deemed to pose lower risk are categorized as either Class I or II. Class II classification usually requires the manufacturer to submit to the FDA a premarket notification submission requesting clearance of the device for commercial distribution in the United States pursuant to Section 510(k) of the FDC Act, referred to as 510(k) clearance. Most Class I devices are exempt from this requirement, as are some lower risk Class II devices with no established special controls. For devices requiring special controls, and when a 510(k) is required, the manufacturer must submit to the FDA a premarket notification submission demonstrating that the device is "substantially equivalent" to: (i) a device that was legally marketed prior to May 28, 1976, for which PMA approval is not required, (ii) a legally marketed device that has been reclassified from Class III to Class II or Class I, or (iii) another legally marketed, similar device that has been cleared through the 510(k) process.

Both Class II and III devices may require clinical studies. All clinical studies of investigational medical devices to determine safety and effectiveness must be conducted in accordance with FDA's investigational device exemption (IDE) regulations, including the requirement for the study sponsor to submit an IDE application to FDA, unless exempt, which must become effective prior to commencing human clinical studies. PMA reviews generally last between three months and two years, although they can take longer. The PMA process can be expensive and lengthy and may not result in clearance (for Class I and II devices) or approval (for Class III devices). If we are required to submit our products for pre-market review by the FDA, we may be required to delay marketing and commercialization while we obtain premarket clearance or approval from the FDA. There would be no assurance that we could ever obtain such clearance or approval.

All medical devices, including in vitro diagnostics, or IVDs, that are regulated by the FDA are also subject to the Quality System Regulation. Obtaining the requisite regulatory approvals, including the FDA quality system inspections that are required for PMA approval, can be expensive, may involve delay, and could conclude without such products being approved by the FDA. Changes to the current regulatory framework, including the imposition of additional or new regulations, could arise at any time during the development or marketing of our products. This may negatively affect our ability to obtain or maintain FDA or comparable regulatory clearance or approval of our products in the future.

IVDs are a category of medical devices that include reagents, instruments, and systems intended for use in diagnosis of disease or other conditions, including a determination of the state of health, in order to cure, mitigate, treat, or prevent disease or its sequelae. IVDs are intended for use in the collection, preparation, and examination of specimens taken from the human body. A RUO IVD product is an IVD product that is in the laboratory research phase of development. As such, an RUO IVD is not intended for use in clinical investigations or in clinical practice. Such RUO products do not require premarket clearance or approval from the FDA, provided that they be labeled "For Research Use Only. Not For Use In Diagnostic Procedures" pursuant to FDA regulations or else they are considered to be adulterated (mislabeled).

As noted above, although our products are currently intended for research purposes only, the regulatory requirements related to marketing, selling, and supporting such products could be uncertain and depend on the totality of circumstances. This uncertainty exists even if such use by our customers occurs without our consent. If the FDA or other regulatory authorities assert that any of our RUO products are subject to regulatory clearance or approval, our business, financial condition, or results of operations could be adversely affected.

According to the FDA, merely including the RUO labeling statement will not necessarily render the device exempt from FDA premarket clearance, approval, or other regulatory requirements if the totality of circumstances surrounding the distribution of the product indicate that the manufacturer intended its IVDs for diagnostic use. Such circumstances may include, but are not limited to, the product's advertising, labeling, or promotion, or the manufacturer's assistance of a clinical laboratory in validating or verifying a test that incorporates products labeled RUO. This uncertainty exists even if such use by our customers occurs without our consent. If the FDA or other regulatory authorities assert that any of our

RUO products are subject to regulatory clearance or approval, our business, financial condition, or results of operations could be adversely affected.

EU Regulation

In the European Union (EU), the new In Vitro Diagnostic Device Regulation (EU) 2017/746, or IVDR, imposes stricter requirements for the marketing and sale of applicable medical devices, including in the area of clinical evaluation requirements, quality systems and post-market surveillance. Some of the IVDR requirements such as general safety and performance requirements became effective in May 2022 while the complete enforcement of the entirety of IVDR will not happen until May 2028. We likely will be impacted by this new regulation, either directly as a manufacturer of IVDs, or indirectly as a supplier to customers who are placing IVDs in the EU market for clinical or diagnostic use. Complying with the IVDR requirements may require us to incur significant expenditures. Failure to meet these requirements could adversely impact our economic operator's business in the EU and other regions that tie their product registrations to the EU requirements.

FSAP

The Federal Centers for Disease Control and Prevention (CDC) and the Animal and Plant Health Inspection Service (APHIS) administer requirements of the Federal Select Agent Program, or FSAP. FSAP requirements govern possession, use, and transfer of select agents and toxins consisting of biological materials that have the potential to pose a severe threat to public, animal or plant health or to animal or plant products. The FSAP currently lists approximately 68 select agents and toxins. The registered entities primarily consist of academic, federal and non-federal government, commercial, and private facilities that conduct research studies or diagnostic activities. We are not a registered entity under FSAP and it is our policy generally not to produce or otherwise work with any biological material that is subject to FSAP license requirements. To the extent that we may possess, use, or transfer any material considered a select agent or toxin under FSAP prospectively, we would seek to register with FSAP and obtain all necessary permits for possession, transfer, importation, or any other regulated activity.

Export controls

Some sequences and synthetic controls we produce may be subject to licensing requirements for export outside of the United States under the U.S. Export Administration Regulations (EAR). Given the evolving nature of our industry, legislative bodies or regulatory authorities may adopt additional regulation or expand existing regulation to include our service. Changes to the current regulatory framework, including the imposition of additional or new regulations, could arise at any time, and we may be unable to obtain or maintain comparable regulatory approval or clearance of our service, if required. These regulations and restrictions may materially and adversely affect our business, financial condition, and results of operations.

Available information

Our corporate website address is *www.twistbioscience.com*. We use the investor relations page of our website for purposes of compliance with Regulation FD and as a routine channel for distribution of important information, including news releases, analyst presentations, financial information and corporate governance practices. Our filings with the SEC are posted on our website and available free of charge as soon as reasonably practical after they are electronically filed with, or furnished to, the SEC. The SEC's website, *www.sec.gov*, contains reports, proxy statements and other information regarding issuers that file electronically with the SEC. The content on any website referred to in this Form 10-K is not incorporated by reference in this Form 10-K unless expressly noted. Further, the Company's references to website URLs are intended to be inactive textual references only.

Item 1A. ***Risk factors***

Risk Factor Summary

Investing in our common stock involves a high degree of risk. You should carefully consider all information in the Annual Report on Form 10-K and in subsequent reports we file with SEC prior to investing in our common stock. These risks are discussed more fully in the section titled "Risk factors." These risks and uncertainties include, but are not limited to, the following:

- We have incurred net losses in every period to date, and we expect to continue to incur significant losses as we develop our business and may never achieve profitability;

- We may require additional financing to achieve our goals, and a failure to obtain this necessary capital when needed on acceptable terms, or at all, could force us to delay, limit, reduce or terminate our product manufacturing and development and other operations;

- If we are unable to maintain adequate revenue growth or do not successfully manage such growth, our business and growth prospects will be harmed;

- Our initiatives to re-balance our cost structure and the associated workforce reductions, publicly announced on May 5, 2023, may not result in anticipated savings, could result in total costs and expenses that are greater than expected and could disrupt our business;

- Rapidly changing technology and extensive competition in synthetic biology could make the products we are developing and producing obsolete or non-competitive unless we continue to develop and manufacture new and improved products and pursue new market opportunities;

- The continued success of our business relies heavily on our disruptive technologies and products and our position in the market as a leading provider of synthetic DNA using a silicon chip;

- If we are unable to expand our DNA synthesis manufacturing capacity, we could lose revenue and our business could be harmed.

- We depend on one single-source supplier for a critical component for our DNA synthesis process. Although we have a reserve of supplies and alternative suppliers exist, the loss of this supplier or its failure to supply us with the necessary component on a timely basis could cause delays in the future capacity of our DNA synthesis process and adversely affect our business;

- We depend on the continuing efforts of our senior management team and other key personnel. If we lose members of our senior management team or other key personnel or are unable to successfully retain, recruit and train qualified researchers, engineering and other personnel, our ability to develop our products could be harmed, and we may be unable to achieve our goals;

- We may engage in strategic transactions, including acquisitions and divestitures that could disrupt our business, cause dilution to our stockholders, reduce our financial resources, or prove not to be successful;

- Our products could in the future be subject to additional regulation by the U.S. Food and Drug Administration or other domestic and international regulatory agencies, which could increase our costs and delay our commercialization efforts, thereby materially and adversely affecting our business and results of operations;

- If we fail to maintain proper and effective internal controls, our ability to produce accurate financial statements on a timely basis could be impaired, which would adversely affect our business;

- Our ability to protect our intellectual property and proprietary technology through patents and other means is uncertain; and

- If we are unable to obtain, maintain and enforce intellectual property protection, others may be able to make, use, or sell products and technologies substantially the same as ours, which could adversely affect our ability to compete in the market.

Risk factors

The following discussion of risk factors contains forward-looking statements. These risk factors may be important to understanding other statements in this Annual Report on Form 10-K. The following information should be read in conjunction with Part II, Item 7, “Management’s discussion and analysis of financial condition and results of operations” and the consolidated financial statements and related notes in Part II, Item 8, “Consolidated financial statements and supplementary data” of this Form 10-K. The risks and uncertainties described below are not the only ones we face. Additional risk and uncertainties not presently known to us or that we presently deem less significant may also impair our business operations. If any of the events or circumstances described in the following risk factors actually occur, our business, operating results, financial condition, cash flows, and prospects could be materially and adversely affected. In that event, the market price of our common stock could decline, and you could lose part or all of your investment.

Our business, financial condition and operating results can be affected by a number of factors, whether currently known or unknown, including but not limited to those described below, any one or more of which could, directly or indirectly, cause our actual financial condition and operating results to vary materially from past, or from anticipated future, financial condition and operating results. Any of these factors, in whole or in part, could materially and adversely affect our business, financial condition, operating results and stock price.

Because of the following factors, as well as other factors affecting our financial condition and operating results, past financial performance should not be considered to be a reliable indicator of future performance, and investors should not use historical trends to anticipate results or trends in future periods.

Risks related to our business

We have incurred net losses in every period to date, and we expect to continue to incur significant losses as we develop our business and may never achieve profitability.

We have incurred net losses each year since inception and have generated limited revenue from product sales to date. We expect to incur increasing costs as we grow our business. We cannot be certain if or when we will produce sufficient revenue from our operations to support our costs. Even if profitability is achieved, we may not be able to sustain profitability. We incurred net losses of $204.6 million, $217.9 million and $152.1 million for the years ended September 30, 2023, 2022 and 2021, respectively. As of September 30, 2023, we had an accumulated deficit of $1,033.0 million. We expect to incur substantial losses and negative cash flow for the foreseeable future. We may incur significant losses in the future for a number of reasons, many of which are beyond our control, including the other risks described in this Form 10-K, market acceptance of our products, business and economic conditions resulting from the COVID-19 outbreaks, future product development, and our market penetration and margins. In addition, inflationary pressure could adversely impact our financial results by increasing operating costs. We may not fully offset these cost increases by raising prices for our products and services, which could result in downward pressure on our margins. Further, our clients may choose to reduce their business with us if we increase our pricing.

We may require additional financing to achieve our goals, and a failure to obtain this necessary capital when needed on acceptable terms, or at all, could force us to delay, limit, reduce or terminate our product manufacturing and development and other operations.

Since our inception, substantially all of our resources have been dedicated to the development of our DNA synthesis platform and our sample preparation kit for NGS. We believe that we will continue to expend substantial resources for the foreseeable future as we continue to expand our production capabilities and enter additional markets we may choose to pursue, including new COVID-19 testing products, pharmaceutical biologics drug discovery and digital data storage in DNA. These expenditures are expected to include costs associated with research and development, increasing manufacturing capabilities, including operating costs of our new Wilsonville, Oregon facility, and increasing supply capabilities as well as marketing and sales capabilities of existing and new products. In addition, other unanticipated costs may arise.

We expect that our existing cash and cash equivalents will be sufficient to fund our planned operating expenses, capital expenditure requirements and debt service payments through at least the next 12 months. However, our operating plan may change as a result of factors currently unknown to us, and as a result, we have sought and may in the future need to seek additional funds sooner than planned, through public or private equity or debt financings or other sources, such as strategic collaborations. In addition, we may seek additional capital due to favorable market conditions or strategic considerations even if we believe we have sufficient funds for our current or future operating plans. Such financing may result in dilution to stockholders, imposition of debt covenants and repayment obligations, or other restrictions that may adversely affect our business.

Our future capital requirements depend on many factors, including:

- the number and characteristics of any additional products or manufacturing processes we develop or acquire to serve new or existing markets;
- the scope, progress, results and costs of researching and developing future products or improvements to existing products or manufacturing processes, including increasing our manufacturing capabilities;
- the cost of manufacturing our DNA synthesis equipment and tools, our NGS sample preparation kits, and any future products we successfully commercialize;

- our ability to establish and maintain strategic collaborations, licensing or other arrangements and the financial terms of such agreements;
- the costs of expanding our sales and marketing capabilities in the United States and in other geographies;
- any lawsuits related to our products or commenced against us or any regulatory actions or proceedings commenced;
- the expenses needed to attract and retain skilled personnel;
- the costs associated with being a public company;
- the costs involved in preparing, filing, prosecuting, maintaining, defending and enforcing patent claims, including litigation costs and the outcome of such litigation; and
- the timing, receipt and amount of sales of, or royalties on, any future approved products, if any.

Additional funds may not be available when we need them, on terms that are acceptable to us, or at all. If adequate funds are not available to us on a timely basis, we may be required to:

- delay, limit, reduce or terminate our manufacturing, research and development activities; or
- delay, limit, reduce or terminate our establishment of marketing and sales capabilities or other activities that may be necessary to generate revenue and achieve profitability.

Our initiatives to re-balance our cost structure and the associated workforce reduction, publicly announced on May 5, 2023, may not result in anticipated savings and could result in total costs and expenses that are greater than expected and could disrupt our business.

In May 2023, the Company's Board of Directors approved a strategic restructuring plan, which included a reduction in force affecting approximately 270 employees worldwide. If we are unable to realize the expected operational efficiencies and cost savings from the announced reduction in force, our operating results and financial condition would be adversely affected. In addition, we may need to undertake additional workforce reductions or restructuring activities in the future. Furthermore, our initiatives to re-balance our cost structure, including the reduction in force, may be disruptive to our operations. For example, our workforce reduction could yield unanticipated consequences, such as attrition beyond planned staff reductions, increased difficulties in our day-to-day operations and reduced employee morale. If employees who were not affected by the reductions in force seek alternative employment, this could result in us seeking contractor support at unplanned additional expense or harm our productivity. Our workforce reduction could also harm our ability to attract and retain qualified management, scientific, and manufacturing personnel who are critical to our business.

If we are unable to maintain adequate revenue growth or do not successfully manage such growth, our business and growth prospects will be harmed.

We have experienced significant revenue growth in a short period of time. We may not achieve similar growth rates in future periods. Investors should not rely on our operating results for any prior periods as an indication of our future operating performance. To effectively manage our anticipated future growth, we must continue to maintain and enhance our manufacturing, sales, financial and customer support administration systems, processes and controls. Failure to effectively manage our anticipated growth could lead us to over-invest or under-invest in development, operational, and administrative infrastructure; result in weaknesses in our infrastructure, systems, or controls; give rise to operational mistakes, losses, loss of customers, productivity or business opportunities; and result in loss of employees and reduced productivity of remaining employees.

Our continued growth could require significant capital expenditures and might divert financial resources from other projects such as the development of new products and services. As additional products are commercialized, we may need to incorporate new equipment, implement new technology systems, or hire new personnel with different qualifications. Failure to manage this growth or transition could result in turnaround time delays, higher manufacturing costs, declining product quality, deteriorating customer service, and slower responses to competitive challenges. A failure in any one of these areas could make it difficult for us to meet market expectations for our products, and could damage our reputation and the prospects for our business.

If our management is unable to effectively manage our anticipated growth, our expenses may increase more than expected, our revenue could decline or grow more slowly than expected and we may be unable to implement our business strategy. In

addition, the quality of our products may suffer, which could negatively affect our reputation and harm our ability to retain and attract customers.

Our quarterly and annual operating results and cash flows have fluctuated in the past and might continue to fluctuate, causing the value of our common stock to decline substantially.

Numerous factors, many of which are outside our control, may cause or contribute to significant fluctuations in our quarterly and annual operating results. These fluctuations may make financial planning and forecasting difficult. In addition, these fluctuations may result in unanticipated decreases in our available cash, which could negatively affect our business and prospects. In addition, one or more of such factors may cause our revenue or operating expenses in one period to be disproportionately higher or lower relative to the others. As a result, comparing our operating results on a period-to-period basis might not be meaningful. You should not rely on our past results as indicative of our future performance. Moreover, our stock price might be based on expectations of future performance that are unrealistic or that we might not meet and, if our revenue or operating results fall below the expectations of investors or securities analysts, the price of our common stock could decline substantially.

Our operating results have varied in the past. As a result, our operating results could be unpredictable, particularly on a quarterly basis. In addition to other risk factors listed in this section, some of the important factors that may cause fluctuations in our quarterly and annual operating results are further described in "Risk factors—Risks relating to owning our stock."

In addition, a significant portion of our operating expense is relatively fixed in nature, and planned expenditures are based in part on expectations regarding future revenue. Accordingly, unexpected revenue shortfalls will decrease our gross margins and could cause significant changes in our operating results from quarter to quarter. If this occurs, the trading price of our common stock could fall substantially.

If we are unable to attract new customers and retain and grow sales from our existing customers, our business will be materially and adversely affected.

In order to grow our business, we must continue to attract new customers and retain and grow sales from our existing customers on a cost-effective basis. To do this, we aim to attract new and existing buyers of synthetic DNA and NGS tool kits, convert makers of synthetic DNA into buyers of synthetic DNA, monetize our antibody discovery platform by entering into partnerships and achieve widespread market acceptance by delivering both our current product offerings and new products and technologies at low cost, with high-quality, reliable turn around times and throughput, superior e-commerce services and effective technical support. We cannot guarantee that our efforts to provide these key requirements will be consistently acceptable to, and meet the performance expectations of, our customers and potential customers. If we are unable to successfully attract and retain customers, our business, financial position and results of operations would be negatively impacted.

If we, or our partners or suppliers, experience a significant disruption in, or breach in security of, information technology systems, or fail to implement new systems and software successfully, our business could be adversely affected. Cyberattacks and security vulnerabilities could lead to reduced revenue, increased costs, liability claims, or harm to our reputation or competitive position.

We rely on several centralized information technology systems throughout our company to provide products, keep financial records, process orders, manage inventory, process shipments to customers and operate other critical functions. In addition, we currently generate a growing portion of our revenue through sales on our e-commerce platform. We manage our website and e-commerce platform internally and as a result any compromise of our security or misappropriation of proprietary information could have a material adverse effect on our business, financial condition and results of operations. We rely on encryption and authentication technology licensed from third parties to provide the security and authentication necessary to effect secure Internet transmission of confidential information, such as credit and other proprietary information. We announced on February 12, 2020 that our information security management system received ISO 27001:2013 certification, an information security standard published by the International Organization for Standardization (ISO), the world's largest developer of voluntary international standards, and the International Electrotechnical Commission. Even though our information security management system received ISO 27001:2013 certification, our, and our partners' or suppliers', information technology systems have been and may still be susceptible to damage, disruptions or shutdowns due to power outages, hardware failures, computer viruses, cyberattacks such as phishing, social engineering, ransomware, denial-of-service and other malware attacks, telecommunication failures, user errors, catastrophes or other unforeseen events. Additionally, some actors are using artificial intelligence ("AI") technology to launch more automated, targeted and coordinated attacks. Our, or our partners' or suppliers' information technology systems also may experience interruptions, delays or cessations of service or produce errors in connection with system integration, software upgrades or system migration work that takes place from time to time. If we were to experience a prolonged system disruption in the

information technology systems that involve our interactions with customers or suppliers, including negatively impacting our order fulfillment and order entry on our e-commerce platform, it could result in the loss of sales and customers and significant incremental costs, which could adversely affect our business.

In addition, security breaches of our, or our partners' or suppliers', information technology systems could result in the misappropriation or unauthorized disclosure of confidential information belonging to us or to our employees, partners, customers or suppliers, including trade secrets or other intellectual property, proprietary business information, and personal information. Cybersecurity incidents, including phishing attacks and attempts to misappropriate or compromise confidential or proprietary information or sabotage enterprise IT systems are becoming increasingly frequent. For example, as the result of a security breach of one of our vendor's email system, we received fraudulent bank account information from the vendor. In addition, we were recently notified by customers of phishing incidents in which they received emails from parties pretending to be us. We have determined that our internal systems were not breached as a result of the unauthorized access to the vendor's email system and the number of phishing incidents were not material. While we have not, to our knowledge, experienced any material system failure, accident, or security breach to date, because techniques used to obtain unauthorized access to or to sabotage systems are constantly evolving and generally are not recognized until they are launched against a target, we cannot be sure that our continued data protection efforts and investment in information technology will prevent significant breakdowns, data leakages, breaches in our systems or the systems of our third party contractors and collaborators, or other cyber incidents in the future that could have a material adverse effect upon our reputation, business, operations, or financial condition. If such an event were to occur, it could materially disrupt our operations and programs, the development of our product candidates and production and shipment of our products. Any event that leads to unauthorized access, use, or disclosure of personal information, including personal information regarding our partners, suppliers or employees, could require us to comply with federal or state breach notification laws and foreign law equivalents, subject us to mandatory corrective action, and otherwise subject us to liability under laws and regulations that protect the privacy and security of personal information and harm our reputation. We would also be exposed to a risk of litigation and potential liability, which could materially adversely affect our business, results of operations and financial condition. In addition, the costs related to significant security breaches or disruptions could be material and exceed the limits of the cybersecurity insurance we maintain against such risks. As a result of any cyber incident, we could incur significant legal and financial exposure and reputational damages that could have a material adverse effect on our business.

Threats involving the misuse of access our network, systems, and information by our current or former employees, contractors, vendors, or partners, whether intentional or unintentional, also pose a risk to the security of our network, systems, and information and data. For example, we are subject to the risk that employees may inadvertently share confidential information with unintended third parties, or that departing employees may take, or create their own information based on, our confidential information upon leaving the company. In addition, any such insiders may be the victims of social engineering attacks that enable third parties to access our network, systems, and information using an authorized person's credentials. We and our network, systems, and information are also vulnerable to malicious acts by insiders, including leaking, modifying, or deleting confidential information, or performing other acts that could materially interfere with our operations and business. While we provide regular training to our employees regarding cybersecurity threats and best practices, we cannot ensure that such training or other efforts will prevent unauthorized access to or sabotage of our network, systems, and information.

In addition, due to political uncertainty and military actions associated with Russia's invasion of Ukraine, we and our third-party providers are at heightened risk of theft or cyber attack of technology, data, and intellectual property through direct intrusion by private parties or foreign actors, including those affiliated with or controlled by nation-state actors. This includes attacks which could materially disrupt our systems and operations, supply chain, and ability to produce, sell and distribute our products and services. If any theft affects or attack our technology, data, or intellectual property, our efforts to protect and enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from our intellectual property, and we may be at heightened risk of losing our proprietary intellectual property rights around the world, including outside of such countries, to the extent such theft, attack or intrusion destroys the proprietary nature of our intellectual property. While we implement security measures designed to reduce these risks, there is no guarantee these measures will be adequate to safeguard all systems and networks. Any failure to maintain performance, reliability, security and availability of our systems and networks may result in accidental or unlawful destruction, damage, loss, unavailability, alteration, impairment, misuse, unauthorized disclosure of, or unauthorized access to our data, including personal or proprietary information.

Our actual operating results may differ significantly from our guidance.

From time to time, we may release guidance in our quarterly earnings conference calls, quarterly earnings releases, or otherwise, regarding our future performance that represents our management's estimates as of the date of release. This guidance, which includes forward-looking statements, is based on projections prepared by our management. This guidance is not prepared with a view toward compliance with published guidelines of the American Institute of Certified Public

Accountants (AICPA) regarding projections or the SEC regarding forward-looking statements, and neither our independent registered public accounting firm nor any other independent expert or outside party compiles or examines the projections. Accordingly, no such person will express any opinion or any other form of assurance with respect to the projections.

Projections are based upon a number of assumptions and estimates that, while presented with numerical specificity, are inherently subject to significant business, economic and competitive uncertainties and contingencies, many of which are beyond our control and are based upon specific assumptions with respect to future business decisions, some of which will change. Our aim is to state possible outcomes as high and low ranges to provide a sensitivity analysis as variables are changed but are not intended to imply that actual results could not fall outside of the suggested ranges. The principal reason that we release guidance is to provide a basis for our management to discuss our business outlook with analysts and investors. We do not accept any responsibility for any projections or reports published by any such third parties.

Guidance is necessarily speculative in nature, and it can be expected that some or all of the assumptions underlying the guidance furnished by us will not materialize or will vary significantly from actual results. Accordingly, our guidance is only an estimate of what management believes is realizable as of the date of release. Actual results may vary from our guidance and the variations may be material. In light of the foregoing, investors are urged not to rely upon our guidance in making an investment decision regarding our common stock.

Any failure to successfully implement our operating strategy or the occurrence of any of the events or circumstances set forth in the "Risk factors" section in this Form 10-K could result in the actual operating results being different from our guidance, and the differences may be adverse and material.

Rapidly changing technology and extensive competition in synthetic biology could make the products we are developing and producing obsolete or non-competitive unless we continue to develop and manufacture new and improved products and pursue new market opportunities.

The synthetic biology industry is characterized by rapid and significant technological changes, frequent new product introductions and enhancements and evolving industry demands and standards. Our future success will depend on our ability to continually improve the products we are developing and producing, to develop and introduce new products that address the evolving needs of our customers on a timely and cost-effective basis and to pursue new market opportunities that develop as a result of technological and scientific advances. These new market opportunities may be outside the scope of our proven expertise or in areas which have unproven market demand, and the utility and value of new products and services developed by us may not be accepted in the markets served by the new products. Our inability to gain market acceptance of existing products in new markets or market acceptance of new products could harm our future operating results. Our future success also depends on our ability to manufacture these new and improved products to meet customer demand in a timely and cost-effective manner, including our ability to resolve manufacturing issues that may arise as we commence production of any new products we develop. Unanticipated difficulties or delays in replacing existing products with new products we introduce or in manufacturing improved or new products in sufficient quantities to meet customer demand could diminish future demand for our products and harm our future operating results. Further, while the impact that AI may have on the synthetic biology industry is still uncertain, recent advances in AI capabilities may indicate that it could be a significant disruptor in the synthetic biology industry. For example, AI may reduce customer demand for certain types of gene synthesis.

In addition, there is extensive competition in the synthetic biology industry, and our future success will depend on our ability to maintain a competitive position with respect to technological advances. Technological development by others may result in our technologies, as well as products developed using our technologies, becoming obsolete. Our ability to compete successfully will depend on our ability to develop proprietary technologies and products that are technologically superior to and/or are less expensive than our competitors' technologies and products. 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.

The continued success of our business relies heavily on our disruptive technologies and products and our position in the market as a leading provider or synthetic DNA using a silicon chip.

Our future profitability will depend on our ability to successfully execute and maintain a sustainable business model and generate continuous streams of revenue. Our business model is premised on the fact that we are the only DNA synthesis provider to synthesize DNA on a silicon chip on a large commercial level and the competitive advantages this creates. Our DNA synthesis methods, among other things, reduce the amount of raw materials required, speed up the synthesis process and deliver large volumes of high-quality synthetic DNA at low unit cost. However, if other competitors develop and commercialize a manufacturing process using a silicon chip or other similar technologies providing for the development of competitive synthetic DNA products at scale, this could be disruptive to our business model and could adversely affect our business prospects, financial condition and results of operations. If we are unable to convert sufficient number of current

manufacturers of synthetic DNA to buyers of our synthetic DNA, surpass our competitors regarding certain industry-related data points, and effectively implement our e-commerce platform which facilitates efficient order entry and fulfillment for our customers, our business, prospects, financial condition and results of operation will be adversely affected.

Issues relating to the use of artificial intelligence and machine learning in our offerings could adversely affect our business and operating results.

We integrate AI and machine learning in our antibody discovery offerings. Issues relating to the use of new and evolving technologies such as AI and machine learning may cause us to experience brand or reputational harm, competitive harm, legal liability, and new or enhanced governmental or regulatory scrutiny, and we may incur additional costs to resolve such issues. As with many innovations, AI presents risks and challenges that could undermine or slow its adoption, and therefore harm our business. For example, perceived or actual technical, legal, compliance, privacy, security, ethical or other issues relating to the use of AI may cause public confidence in AI to be undermined, which could slow our customers' adoption of our products and services that use AI. In addition, litigation or government regulation related to the use of AI may also adversely impact our and others' abilities to develop and offer products that use AI, as well as increase the cost and complexity of doing so. Developing, testing and deploying AI systems may also increase the cost profile of our product offerings due to the nature of the computing costs involved in such systems, which could impact our project margin and adversely affect our business and operating results. Further, market demand and acceptance of AI technologies are uncertain, and we may be unsuccessful in our product development efforts.

If we are unable to expand into adjacent addressable markets, our business may be materially and adversely affected.

Our future revenue growth and market potential may depend on our ability to leverage our DNA synthesis platform together with our custom libraries and other proprietary tools, such as our antibody discovery and optimization platform, in adjacent businesses such as pharmaceutical biologics drug discovery and digital data storage in DNA. There can be no assurance that we can continue to utilize our antibody libraries to accelerate the lead identification and lead optimization steps of antibody discovery or to discover more effective antibody drugs. In addition, our technology may not develop in a way that allows data storage in DNA to become cost competitive with traditional data storage media or in a way that otherwise enables us to address the markets opportunities that we believe exist. If we are unable to expand into adjacent addressable markets, our business, financial position and results of operations could be negatively impacted.

A significant portion of our sales depends on customers' budgets that may be subject to significant and unexpected variation, including seasonality.

Our customers' spending on research and development impacts our sales and profitability. Our customers and potential customers include chemicals/materials, diagnostics, therapeutics, food/agriculture, and their budgets can have a significant effect on the demand for our products. Their research and development budgets are based on a wide variety of factors, including factors beyond our control, such as:

- the allocation of available resources to make purchases;
- funding from government sources;
- funding from research grants;
- changes in government programs that provide funding to research institutions and companies;
- the spending priorities among various types of research equipment;
- policies regarding capital expenditures during recessionary periods;
- political climate or macroeconomic conditions, including economic downturns or market uncertainty or reduced spending in response to emergency situations, such as the outbreak of COVID-19;
- inability to raise sufficient funds in the capital markets;
- changes in the regulatory environment;
- healthcare legislative reform measures, such as the Inflation Reduction Act of 2022;
- differences in budgetary cycles;

- inflationary pressures; and
- market acceptance of relatively new technologies, such as ours.

Any decrease in spending or change in spending priorities of our customers and potential customers could significantly reduce the demand for our products. As we expand into new geographic markets, our revenue may be impacted by seasonal trends in the different regions, the seasonality of customer budgets in those regions and the mix of domestic versus international sales. In addition, access to capital markets is critical to many of our customers' ability to fund their operations, including purchase our products and services. Traditionally, biotechnology and life sciences companies have funded their research and development expenditures by raising capital in the equity markets. Declines and uncertainties in these markets have severely restricted raising new capital and have affected companies' ability to fund existing research and development efforts which may lead them to delay project starts, reduce or cancel orders and or cancel projects. In the past, we experienced some cancellations of customer orders that we believe were due to customers' funding concerns. Moreover, we have no control over the timing and volume of purchases by these customers and potential customers, and as a result, revenue from these sources may vary significantly due to factors that can be difficult to forecast. Any delay or reduction in purchases by customers and potential customers or our inability to forecast fluctuations in demand could harm our future operating results.

We generally do not have long-term contracts with our customers requiring them to purchase any specified quantities from us.

We generally do not have long-term contracts with our customers requiring them to purchase any specified quantities from us and without such contracts our customers are not obligated to order or reorder our products. As a result, we cannot accurately predict our customers' decisions to reduce or cease purchasing our products. Additionally, even where we enter into contracts with our customers, there is no guarantee that such agreements will be negotiated on terms that are commercially favorable to us in the long-term. Therefore, if many of our customers were to substantially reduce their transaction volume or cease ordering products from us, this could materially and adversely affect our financial performance.

We may be unable to successfully recruit and maintain adequate sales, marketing and other support personnel in order to increase our market share and expand our customer base.

Our ability to achieve profitability depends on our being able to increase our market share and expand our customer base. Although members of our sales and marketing teams have considerable industry experience and have engaged in marketing activities for our products, in the future we must expand our sales, marketing, distribution and customer support capabilities with the appropriate technical expertise to effectively market our products. Furthermore, it takes six to nine months to recruit, onboard and ramp sales personnel to full capability. To perform sales, marketing, distribution and customer support successfully, we will face a number of risks, including that:

- we may not be able to attract, retain and manage the sales, marketing and service workforce necessary to publicize and gain broader market acceptance of our technology;
- the time and cost of establishing a specialized sales, marketing and service force for a particular product or service, which may be difficult to justify in light of the revenue generated;
- our field sales personnel may not be able to access our customers' premises which could delay the adoption and ordering of our products; and
- our sales, marketing and service force may be unable to initiate and execute successful commercialization activities with respect to new products or markets we may seek to enter.

If our sales and marketing efforts, or those of any third-party sales and distribution partners, are not successful, our new technologies and products may not gain market acceptance, which could materially impact our business operations.

The United Kingdom's ("U.K.") referendum to exit from the European Union ("E.U.") will continue to have uncertain effects and could adversely impact our business, results of operations and financial condition.

As a result of a referendum in June 2016, the U.K. withdrew from the E.U. ("Brexit") on January 31, 2020. It began a transition period in which to negotiate a new trading relationship for goods and services that ended on December 31, 2020. During the time since the June 2016 referendum, there have been periods of significant volatility in the global stock markets and currency exchange rates, as well as challenging market conditions in the U.K. On December 24, 2020, the U.K. and E.U. announced they had entered into a post-Brexit deal on certain aspects of trade and other strategic and political issues. We are continuing to evaluate our own risks and uncertainty related to ascertain what financial, trade,

regulatory and legal implications this new Brexit trade deal could have on our U.K. and European business operations. This uncertainty also includes the impact on our customers' business operations and capital planning as well as the overall impact on the biotechnology industry in the U.K. While we have not experienced any direct material financial impact since the 2016 referendum, we cannot predict its future implications, and Brexit and its related effects could result in a negative impact on our consolidated financial position and results of operations.

If we are unable to expand our DNA synthesis manufacturing capacity, we could lose revenue and our business could be harmed.

In order to expand our manufacturing capacity of new and existing products, we may need to either build additional internal manufacturing capacity, contract with one or more partners, or both. Our production facility in Wilsonville, Oregon has increased our manufacturing capacity, but if customer demand increases, we may need to expand manufacturing capacity further, which could impact our revenue growth. Our technology and the production process for our DNA synthesis equipment and tools are complex, involving specialized parts, and we may encounter unexpected difficulties in the manufacture, improvement or increasing the capacity of our DNA synthesis equipment and tools, and addressing these difficulties may cause us to divert our time and resources from our other product offerings. There is no assurance that we will be able to continue to increase manufacturing capacity internally or that we will find one or more suitable partners to help us towards this objective, in order to meet the volume and quality requirements necessary for success in our existing and potential markets. Manufacturing and product quality issues may arise as we continue to increase the scale of our production. If our DNA synthesis equipment and tools do not consistently produce DNA products that meet our customers' performance expectations, our reputation may be harmed, and we may be unable to generate sufficient revenue to become profitable. Any delay or inability in expanding our manufacturing capacity could diminish our ability to develop or sell our products, which could result in lost revenue and materially harm our business, financial condition and results of operations.

We are substantially dependent on the success of our synthetic DNA products.

To date, we have invested a substantial portion of our efforts and financial resources towards the research and development and commercialization of our synthetic DNA products. The DNA synthesis business is very capital intensive, particularly for early-stage companies that do not have significant off-setting revenues and which are making significant investments in the commercialization and marketing of their products.

Substantially all of our revenue generated to date is from our synthetic DNA products. Our financial results are dependent on strengthening our core business while diversifying into other developing sectors such as pharmaceutical biologics drug discovery, creating useful DNA libraries and data storage.

Our near-term prospects, including our ability to finance our research and development activities and initiatives and enter into strategic collaborations, will depend heavily on the successful development and commercialization of our synthetic DNA products. These initiatives will be substantially dependent on our ability to generate revenue from our synthetic DNA products and obtain other funding necessary to support these initiatives. Our inability to continue these initiatives and initiate new research and development efforts could result in a failure to develop new products, improve upon existing products such that sectors such as pharmaceutical biologics drug discovery, DNA library creation and data storage may never be fully developed, and expand our addressable market, which could have a material and adverse impact on our sales, business, financial position and results of operations.

We depend on one single-source supplier for a critical component for our DNA synthesis process. Although we have a reserve of supplies and alternative suppliers exist, the loss of this supplier or its failure to supply us with the necessary component on a timely basis could cause delays in the future capacity of our DNA synthesis process and adversely affect our business.

We depend on one single-source supplier for a critical component for our DNA synthesis process. We do not currently have the infrastructure or capability internally to manufacture this component. Although we have a reserve of supplies and although alternative suppliers exist for this critical component of our synthesis process, our existing DNA synthesis manufacturing process has been designed based on the functions, limitations, features and specifications of the components that we currently utilize. We have a supply agreement in place with this component supplier. However, there can be no assurance that our supply of this component will not be limited, interrupted, or of satisfactory quality or continue to be available at acceptable prices. Additionally, we do not have any control over the process or timing of the acquisition or manufacture of materials by our supplier and cannot ensure that it will deliver to us the component we order on time, or at all.

The loss of this component provided by this supplier could require us to change the design of our manufacturing process based on the functions, limitations, features and specifications of the replacement components.

In addition, the lead time needed to establish a relationship with a new supplier can be lengthy, and we may experience delays in meeting demand in the event we must switch to a new supplier. The time and effort to qualify a new supplier

could result in additional costs, diversion of resources or reduced manufacturing yields, any of which would negatively impact our operating results. Further, we may be unable to enter into agreements with a new supplier on commercially reasonable terms, which could have a material adverse impact on our business. Our dependence on this single-source supplier exposes us to certain risks, including the following:

- our supplier may cease or reduce production or deliveries, raise prices or renegotiate terms;
- we may be unable to locate a suitable replacement on acceptable terms or on a timely basis, if at all;
- if there is a disruption to our single-source supplier's operations, and if we are unable to enter into arrangements with alternative suppliers, we will have no other means of completing our synthesis process until they restore the affected facilities or we or they procure alternative manufacturing facilities or sources of supply;
- delays caused by supply issues may harm our reputation, frustrate our customers and cause them to turn to our competitors for future projects; and
- our ability to progress our DNA synthesis products could be materially and adversely impacted if the single-source supplier upon which we rely were to experience a significant business challenge, disruption or failure due to issues such as financial difficulties or bankruptcy, issues relating to other customers such as regulatory or quality compliance issues, or other financial, legal, regulatory, operational or reputational issues.

Moreover, to meet anticipated market demand, our single-source supplier may need to increase manufacturing capacity, which could involve significant challenges. This may require us and our supplier to invest substantial additional funds and hire and retain the technical personnel who have the necessary experience. Neither we nor our supplier may successfully complete any required increase to existing manufacturing capacity in a timely manner, or at all.

We must continue to secure and maintain sufficient and stable supplies of raw materials. Any shortage of raw materials or materials necessary for our production capabilities may adversely affect our business.

Although historically we have not experienced price increases due to unexpected shortages in raw materials or other materials and other unanticipated events, there is no assurance that our supply of raw materials or other materials will not be significantly adversely affected in the future, which may in turn adversely affect our business, prospects, financial condition and results of operation.

In addition, as we grow, our existing suppliers may not be able to meet our increasing demand, and we may need to find additional suppliers. There is no assurance that we will always be able to secure suppliers who provide raw materials at the specification, quantity and quality levels that we demand (or at all) or be able to negotiate acceptable fees and terms of services with any such suppliers. Identifying a suitable supplier is an involved process that requires us to become satisfied with their quality control, responsiveness and service, financial stability and labor and other ethical practices. Even if we are able to expand existing sources, we may encounter delays in production and added costs as a result of the time it takes to train suppliers in our methods, products and quality control standards.

We typically do not enter into agreements with our suppliers but secure our raw materials and component parts we use in our equipment on a purchase order basis. Our suppliers may reduce or cease their supply of raw materials, component parts and outsourced services and products to us at any time in the future. If the supply of raw materials, component parts and the outsourced services and products is interrupted due to shortages or other reasons, our production processes may be delayed. If any such event occurs, our operation and financial position may be adversely affected.

A deterioration of our relationship with any of our suppliers, or problems experienced by these suppliers, could lead to shortages in our production capacity for some or all of our products. In such case, we may not be able to fulfill the demand of existing customers or supply new customers. In addition, shortages of raw materials or component parts or an increase in the cost of the raw materials or component parts we use could result in decreased revenue or could impair our ability to maintain or expand our business.

While we have experienced increased operating costs in recent periods, which we believe are due in part to the recent growth in inflation, we do not believe that inflation has had a material effect on our business, financial condition or results of operations. In the event of significant price increases for raw materials, we may have to pass the increased raw materials costs to our customers. However, we cannot assure you that we will be able to raise the prices of our products sufficiently to cover increased costs resulting from increases in the cost of our raw materials or overcome the interruption of a sufficient supply of qualified raw materials for our products. As a result, a price increase for our raw materials may negatively impact our business, financial position and results of operations.

We may encounter difficulties in managing our growth, and these difficulties could impair our profitability.

Currently, we are working simultaneously on multiple projects, expanding our capacity as well as targeting several market sectors, including activities in the chemicals/materials, diagnostics, therapeutics, food and data storage sectors. In addition, we work to renew our ISO certifications from time to time. These diversified operations and activities place significant demands on our limited resources and require us to substantially expand the capabilities of our technical, administrative and operational resources.

If we are unable to manage this growth and the periodic ISO recertification of our manufacturing facilities effectively, our shipments to our customers could be impacted, our time and resources could be diverted from other products and offerings and our business and operating results could suffer. In addition, if we fail to timely deliver products or meet quantity requirements under our contracts with customers, we may offer discounts to them, and customers' minimum purchase requirements, if applicable, may be reduced. Our ability to manage our operations and costs, including research and development, costs of components, manufacturing, sales and marketing, requires us to continue to enhance our operational, financial and management controls, reporting systems and procedures and to attract and retain sufficient numbers of talented employees. Failure to attract and retain sufficient numbers of talented employees will further strain our human resources and could impede our growth.

Our revenue, results of operations, cash flows and reputation in the marketplace may suffer upon the loss of a limited number of large customers.

We have derived, and believe we may continue to derive, a significant portion of our revenues from a limited number of large customers. Our customers may buy less of our products depending on their own technological developments, end-user demand for our products and internal budget cycles. In addition, existing customers may choose to produce some or all of their synthetic DNA requirements internally by using or developing manufacturing capabilities organically or by using capabilities from acquisitions of assets or entities from third parties with such capabilities. The loss of any significant customer or a significant reduction in the amount of product ordered by Ginkgo or any other significant customer would adversely affect our revenue, results of operations, cash flows and reputation in the marketplace.

We depend on the continuing efforts of our senior management team and other key personnel. If we lose members of our senior management team or other key personnel or are unable to successfully retain, recruit and train qualified researchers, engineering and other personnel, our ability to develop our products could be harmed, and we may be unable to achieve our goals.

Our future success depends upon the continuing services of members of our senior management team and scientific and engineering personnel. We are highly dependent on Dr. Emily Leproust, our Chief Executive Officer, who is employed "at will," meaning we or she may terminate the employment relationship at any time. In particular, our researchers and engineers are critical to our future technological and product innovations, and we will need to hire additional qualified personnel. We may not be able to attract and retain qualified personnel on acceptable terms, or at all. In addition, to the extent we hire personnel from competitors, we may be subject to allegations that they have been improperly solicited or that they have divulged proprietary or other confidential information, or that their former employers own their research output. Our industry, particularly in the San Francisco Bay Area, is characterized by high demand and intense competition for talent, and the turnover rate can be high. We compete for qualified management and scientific personnel with other life science companies, academic institutions and research institutions, particularly those focusing on genomics.

Many of these employees could leave our company with little or no prior notice and would be free to work for a competitor. If one or more of our senior executives or other key personnel were unable or unwilling to continue in their present positions, we might not be able to replace them easily or at all, and other senior management may be required to divert attention from other aspects of the business. In addition, we do not have "key person" life insurance policies covering members of our management team or other key personnel except Dr. Leproust. While we conduct succession planning to identify the person(s) for key positions who possess the skills and capabilities to take on the responsibilities filled by our leaders, we cannot assure you that these strategies will successfully mitigate the loss of any key personnel. The loss of any of these individuals or our inability to attract or retain qualified personnel, including researchers, engineers and others, could prevent us from pursuing collaborations and adversely affect our product development and introductions, business growth prospects, results of operations and financial condition.

We may engage in strategic transactions, including acquisitions, collaborations, or investments in other companies or technologies, that could disrupt our business, cause dilution to our stockholders, reduce our financial resources, or prove not to be successful.

We may enter into transactions to acquire other businesses, products or technologies and our ability to do so successfully cannot be ensured. While historically we have not completed many acquisitions, we closed a business acquisition in the first quarter of 2022 and we are continuing to pursue opportunities in the life sciences industry that complement and

expand our synthetic DNA product and our other products in both local and international markets. If we identify suitable opportunities, we may not be able to make such acquisitions on favorable terms or at all. Any acquisitions we make may not strengthen our competitive position, and these transactions may be viewed negatively by customers or investors. We may decide to incur debt in connection with an acquisition or issue our common stock or other equity securities to the stockholders of the acquired company, as we did for the business acquisitions, which would reduce the percentage ownership of our existing stockholders. We could incur losses resulting from undiscovered liabilities of the acquired business that are not covered by any indemnification we may obtain from the seller. In addition, we may not be able to successfully integrate the acquired personnel, technologies and operations into our existing business in an effective, timely and non-disruptive manner. Acquisitions may also divert management attention from day-to-day responsibilities, increase our expenses and reduce our cash available for operations and other uses. In addition, we cannot guarantee that we will be able to fully recover the costs of such acquisitions or that we will be successful in leveraging any such strategic transactions into increased business, revenue or profitability. We also cannot predict the number, timing or size of any future acquisitions or the effect that any such transactions might have on our operating results.

From time to time, we may consider other strategic transactions, including collaborations or investments in other companies. The competition for collaborators is intense, and the negotiation process is time-consuming and complex. Any new collaboration may be on terms that are not optimal for us, and we may not be able to maintain any new collaboration. Any such collaboration may require us to incur non-recurring or other charges, increase our near- and long-term expenditures and pose significant integration or implementation challenges or disrupt our management or business. These transactions would entail numerous operational and financial risks, including exposure to unknown liabilities, disruption of our business and diversion of our management's time and attention to manage a collaboration, incurrence of substantial debt or dilutive issuances of equity securities to pay transaction consideration or costs, higher than expected collaboration, acquisition or integration costs, write-downs of assets or goodwill or impairment charges, increased amortization expenses, difficulty and cost in facilitating the collaboration or combining the operations and personnel of any acquired business, impairment of relationships with key suppliers, manufacturers or customers of any acquired business due to changes in management and ownership and the inability to retain key employees of any acquired business. Antitrust or other competition laws may also limit our ability to acquire or work collaboratively with certain businesses or to fully realize the benefits of strategic transactions to acquire or collaborate with other businesses. Accordingly, although there can be no assurance that we will undertake or successfully complete any collaborations, any transactions that we do complete may be subject to the foregoing or other risks and have a material and adverse effect on our business, financial condition, results of operations and prospects. Conversely, any failure to enter into any collaboration or other strategic transaction that would be beneficial to us could delay the development and potential commercialization of our products and technologies.

As we expand our development and commercialization activities outside of the United States, we will be subject to an increased risk of inadvertently conducting activities in a manner that violates the U.S. Foreign Corrupt Practices Act and similar laws. If that occurs, we may be subject to civil or criminal penalties which could have a material adverse effect on our business, financial condition, results of operations and growth prospects.

We are subject to the U.S. Foreign Corrupt Practices Act, or the FCPA, which prohibits corporations and individuals from paying, offering to pay, or authorizing the payment of anything of value to any foreign government official, government staff member, political party, or political candidate in an attempt to obtain or retain business or to otherwise influence a person working in an official capacity. We are also subject to the UK Anti-Bribery Act, which prohibits both domestic and international bribery, as well as bribery across both public and private sectors. We require that our employees review our Code of Business Conduct and Ethics, our Anti-Money Laundering Policy and our Anti-Corruption Policy on an annual basis.

In the course of establishing and expanding our commercial operations and complying with non-U.S. regulatory requirements, we will need to establish and expand business relationships with various third parties and we will interact more frequently with foreign officials, including regulatory authorities. Expanded programs to maintain compliance with such laws will be costly and may not be effective. Any interactions with any such parties or individuals where compensation is provided that are found to be in violation of such laws could result in substantial fines and penalties and could materially harm our business. Furthermore, any finding of a violation under one country's laws may increase the likelihood that we will be prosecuted and be found to have violated another country's laws. We require that our employees annually certify that they understand and will comply with our Code of Business Conduct and Ethics Policy, our Anti-Money Laundering Policy, our Anti-Corruption Policy as well as the UK Modern Slavery Act of 2015. Even so, if our business practices outside the United States are found to be in violation of the FCPA, UK Anti-Bribery Act, antitrust or other similar laws, we may be subject to significant civil and criminal penalties which could have a material adverse effect on our financial condition and results of operations.

We could engage in exporting or related activity that contravenes international trade restraints, or regulatory authorities could promulgate more far-reaching international trade restraints, which could give rise to one or more of substantial legal liability, impediments to our business and reputational damage.

Our international business activities must comport with U.S. export controls and other international trade restraints, including the U.S. Department of Commerce's Export Administration Regulations and economic sanctions regulations administered by the U.S. Treasury Department's Office of Foreign Assets Controls.

We have established an international trade compliance program that encompasses best practices for preventing, detecting and addressing noncompliance with international trade restraints. Furthermore, to date our exports have not been licensable under export controls; however, we could fail to observe the compliance program requirements in a manner that leaves us in noncompliance with export controls or other international trade restraints. In addition, authorities could promulgate international trade restraints that impinge on our ability to pursue our business as planned. One or more of resulting legal penalties, restraints on our business or reputational damage could have material adverse effects on our business and financial condition.

We operate in a highly competitive industry and if we are not able to compete effectively, our business and operating results will likely be harmed.

We face competition from a broad range of providers of core synthetic biology products such as GenScript Biotech Corporation, DNA Script, Inc., GENEWIZ (owned by Azenta), Integrated DNA Technologies, Inc. (owned by Danaher Corporation), DNA 2.0 Inc. d/b/a/ ATUM, GeneArt (owned by Thermo Fisher Scientific Inc.), Eurofins Genomics LLC, Sigma-Aldrich Corporation (owned by Charles River Laboratories, Inc.) (an indirect wholly owned subsidiary of Merck & Company), Promega Corporation, OriGene Technologies, Inc., Blue Heron Biotech, LLC and others. Additionally, we compete with both large and emerging providers in the life sciences tools and diagnostics industries focused on sample preparation for NGS such as Thermo Fisher Scientific Inc., Illumina, Inc., Integrated DNA Technologies, Inc. and Agilent. In the antibody discovery market, we compete with clinical research organizations, such as Curia, GenScript, and Genovac (formerly part of Aldevron, LLC), and antibody discovery biotechnology companies, such as Fair Journey/Iontas, Adimab, Zymeworks, Distributed Bio (owned by Charles River), Ablexis, Specifica, OmniAb and AbCellera Biologics Inc. In the emerging field of DNA digital data storage, we compete with Catalog Technologies, Inc., Helixworks, Iridia, Inc., Roswell, Seagate, Microsoft, GenScript, Molecular Assemblies, Ansa Biotechnologies, various academic institutions, and other emerging competitors. We may not be successful in maintaining our competitive position for a number of reasons. Some of our current competitors, as well as many of our potential competitors, have significant name recognition, substantial intellectual property portfolios, longer operating histories, greater resources to invest in new technologies, substantial experience in new product development and manufacturing capabilities and more established distribution channels to deliver products to customers than we do. These competitors may be able to respond more quickly and effectively than we can to new or changing opportunities, technologies, standards or customer requirements. Our competitors may develop disruptive technologies or products that are comparable or superior to our technologies and products. In light of these advantages, even though we believe our technology is superior to the products offerings of our competitors, current or potential customers might accept competitive products in lieu of purchasing our products. Increased competition is likely to result in continued pricing pressures, which could harm our sales, profitability or market share. Our failure to continue competing effectively or winning additional business with our existing customers could materially and adversely affect our business, financial condition or results of operations.

We may be subject to significant pricing pressures and if we are unable to pass on any cost increase to our customers, our business, financial position and results of operations could be adversely affected.

Over time, increasing customer demand for lower prices could force us to discount our products and result in lower margins. The impact may be further exacerbated if we are unable to successfully control production costs. In addition, if due to rising market prices as a result of inflation or otherwise, our suppliers increase prices or reduce discounts on their supplies, we may be unable to pass on any cost increase to our customers, thereby resulting in reduced margins and profits. Furthermore, changes in our product mix may negatively affect our gross margins. Overall, these pricing pressures may adversely affect our business, financial position and results of operations.

Ethical, legal and social concerns surrounding the use of genetic information could reduce demand for our technology.

Our products may be used to create DNA sequences of humans, agricultural crops and other living organisms. Our products could be used in a variety of applications, which may have underlying ethical, legal and social concerns. Governmental authorities could, for safety, social or other purposes, impose limits on or implement regulation of the use of gene synthesis. Such concerns or governmental restrictions could limit the use of our DNA synthesis products, which could have a material adverse effect on our business, financial condition and results of operations. In addition, public perception about the safety and environmental hazards of, and ethical concerns over, genetically engineered products and processes could influence public acceptance of our technologies, products and processes. These concerns could result in increased expenses, regulatory scrutiny, delays or other impediments to our programs.

We use biological and hazardous materials that require considerable expertise and expense for handling, storage and disposal and may result in claims against us.

We work with materials, including chemicals, biological agents, and compounds and DNA samples that could be hazardous to human health and safety or the environment. Our operations also produce hazardous and biological waste products. Federal, state and local laws and regulations govern the use, generation, manufacture, storage, handling and disposal of these materials and wastes. Compliance with applicable environmental laws and regulations is expensive, and current or future environmental laws and regulations may restrict our operations. If we do not comply with applicable regulations, we may be subject to fines and penalties.

In addition, we cannot eliminate the risk of accidental injury or contamination from these materials or wastes, which could cause an interruption of our commercialization efforts, research and development programs and business operations, as well as environmental damage resulting in costly clean-up and liabilities under applicable laws and regulations. Furthermore, environmental laws and regulations are complex, change frequently and have tended to become more stringent. We cannot predict the impact of such changes and cannot be certain of our future compliance. While our property insurance policy provides limited coverage in the event of contamination from hazardous and biological products and the resulting cleanup costs, we do not currently have any additional insurance coverage for legal liability for claims arising from the handling, storage or disposal of hazardous materials. Accordingly, in the event of contamination or injury, we could be liable for damages or penalized with fines in an amount exceeding our resources and our operations could be suspended or otherwise adversely affected.

We could develop DNA sequences or engage in other activity that contravenes biosecurity requirements, or regulatory authorities could promulgate more far-reaching biosecurity requirements that our standard business practices cannot accommodate, which could give rise to substantial legal liability, impede our business and damage our reputation.

The Federal Select Agent Program, or the FSAP, involves rules administered by the Centers for Disease Control and Prevention and Toxins and the Animal and Plant Health Inspection Service that regulate possession, use and transfer of biological select agents and toxins that have the potential to pose a severe threat to public, animal or plant health or to animal or plant products.

We have established a comprehensive, biosecurity program under which we follow biosafety and biosecurity best practices and avoid DNA synthesis activities that implicate FSAP rules; however, we could inadvertently err in our observance of compliance program requirements in a manner that leaves us in noncompliance with FSAP or other biosecurity rules. In addition, authorities could promulgate new biosecurity requirements that restrictions our operations. One or more resulting legal penalties, restraints on our business or reputational damage could have material adverse effects on our business and financial condition.

Third parties may use our products in ways that could damage our reputation.

After our customers have received our products, we do not have any control over their use and our customers may use them in ways that are harmful to our reputation as a supplier of synthetic DNA products. In addition, while we have established a biosecurity program designed to comply with biosafety and biosecurity requirements and perform export control screening in an effort to ensure that third parties do not obtain our products for malevolent purposes, we cannot guarantee that these preventative measures will eliminate or reduce the risk of the domestic and global opportunities for the misuse of our products. Accordingly, in the event of such misuse, our reputation, future revenue and operating results may suffer.

Any damage to our reputation or brand may materially and adversely affect our business, financial condition and results of operations.

We believe that developing and maintaining our brand is important to our success and that our financial success is influenced by the perception of our brand by our customers. Furthermore, the importance of our brand recognition may become even greater to the extent that competitors offer more products similar to ours. Many factors, some of which are beyond our control, are important to maintaining our reputation and brand. These factors include our ability to comply with ethical, social, product, labor and environmental standards. Any actual or perceived failure in compliance with such standards could damage our reputation and brand.

Because we are subject to existing and potential additional governmental regulation, the markets for our products may be narrowed.

We are subject, both directly and indirectly, to the adverse impact of existing and potential future government regulation of our operations and markets. For example, the export of our products is subject to strict regulatory control in a number of jurisdictions. The failure to satisfy export control criteria or obtain necessary clearances could delay or prevent the shipment of products, which could adversely affect our revenues and profitability. Moreover, the life sciences industry,

which is currently the primary market for our technology, has historically been heavily regulated. There are, for example, laws in several jurisdictions restricting research in genetic engineering, which can operate to narrow our markets. Given the evolving nature of this industry, legislative bodies or regulatory authorities may adopt additional regulation that adversely affects our market opportunities. Our business is also directly affected by a wide variety of government regulations applicable to business enterprises generally and to companies operating in the life science industry in particular. Failure to comply with these regulations or obtain or maintain necessary permits and licenses could result in a variety of fines or other censures or an interruption in our business operations which may have a negative impact on our ability to generate revenues and could increase the cost of operating our business.

Our products could in the future be subject to additional regulation by the U.S. Food and Drug Administration or other domestic and international regulatory agencies, which could increase our costs and delay our commercialization efforts, thereby materially and adversely affecting our business and results of operations.

The FDA regulates medical devices, including in vitro diagnostics, or IVDs. IVDs are a category of medical devices that include reagents, instruments, and systems intended for use in diagnosis of disease or other conditions, including a determination of the state of health, in order to cure, mitigate, treat, or prevent disease or its sequelae. IVDs are intended for use in the collection, preparation, and examination of specimens taken from the human body. An RUO IVD product is an IVD product that is in the laboratory research phase of development. As such, an RUO IVD is not intended for use in clinical investigations or in clinical practice. Such RUO products do not require premarket clearance or approval from the FDA, provided that they are labeled "For Research Use Only. Not For Use In Diagnostic Procedures" pursuant to FDA regulations. Our IVD products are not intended for clinical or diagnostic use, and we market and label them as RUO. Our customers, however, may use our products in their own laboratory-developed tests, or LDTs. The FDA has historically taken the position that LDTs are considered to be IVDs, but has generally exercised enforcement discretion. On September 29, 2023, the FDA issued a proposed rule that would phase out the policy of enforcement discretion it has historically applied to most LDTs (the "LDT Proposed Rule"). If the FDA increases regulatory requirements pursuant to the LDT Proposed Rule or other rules, it may influence the sales of our products and how customers employ our products, and we could be subject to additional regulatory controls including enforcement action, administrative and judicial sanctions, all of which could adversely affect our business, financial condition, or results of operations.

In the future, certain of our products or related applications could be subject to additional FDA regulation. Even where a product is not subject to FDA clearance or approval requirements or deemed exempt, the FDA may impose restrictions as to the types of customers to which we can market and sell our products. Such regulation and restrictions may materially and adversely affect our business, financial condition and results of operations. Other regulatory regimes that do not currently present material challenges but that could in the future present material challenges include export controls and biosecurity.

Many countries have laws and regulations that could affect our products and which could limit our ability to sell our products in those countries. The number and scope of these requirements are increasing. We may not be able to obtain regulatory approvals in such countries or may incur significant costs in obtaining or maintaining foreign regulatory approvals. For example, the European Union requires manufacturers to adhere to the In Vitro Diagnostic Device Regulation (EU) 2017/746, or IVDR, for the marketing and sale of medical devices. Complying with the requirements of the IVDR may require us to incur significant expenditures. Failure to meet these requirements could adversely impact our business in the EU and other regions that tie their product registrations or chemical regulations to the EU requirements.

Certain of our potential customers may require that we become certified under the Clinical Laboratory Improvement Amendments of 1988.

Although we are not currently subject to the Clinical Laboratory Improvement Amendment of 1988, or CLIA, we may in the future be required by certain customers to obtain a CLIA certification. CLIA, which extends federal oversight over clinical laboratories by requiring that they be certified by the federal government or by a federally approved accreditation agency, is designed to ensure the quality and reliability of clinical laboratories by mandating specific standards in the areas of personnel qualifications, administration and participation in proficiency testing, patient test management, quality control, quality assurance and inspections. If our customers require a CLIA certification, we will have to continually expend time, money and effort to ensure that we meet the applicable quality and safety requirements, which may divert the attention of management and disrupt our core business operations.

Our manufacturing operations in the United States currently depend primarily on our Wilsonville facility. If this facility is destroyed or we experience any manufacturing difficulties, disruptions, or delays, this could limit supply of our product or adversely affect our ability to sell products or conduct our clinical trials, and our business would be adversely impacted.

Although a portion of our manufacturing still takes place at our headquarters in South San Francisco, California, we depend primarily on our manufacturing facility in Wilsonville, Oregon. For example, we are consolidating synthetic biology production in Wilsonville, and our Express Genes product is manufactured solely in Wilsonville. Any manufacturing difficulties at our Wilsonville facility could result in turnaround time delays. If regulatory, manufacturing, or other problems require us to discontinue production at our Wilsonville facility, we will not be able to manufacture our synthetic genes, oligo pools or selected NGS products or create our DNA libraries, which would adversely impact our business. If this facility or the equipment in it is significantly damaged or destroyed by fire, flood, power loss, or similar events, or is shut down for health and safety or other reasons, we may not be able to quickly or inexpensively replace our manufacturing capacity or replace the facility at all. In the event of a temporary or protracted loss of this facility or equipment, we might not be able to transfer manufacturing to another third party. Even if we could transfer manufacturing from one facility to another, the shift would likely be expensive and time-consuming, particularly if we were to maintain the current manufacturing standards procedures at such alternative facility.

Natural disasters, public health crises, political crises, and other catastrophic events or other events outside of our control may damage our facilities or the facilities of third parties on which we depend and could impact our ability to sell products.

Our headquarters in South San Francisco, California is located near known earthquake fault zones and is vulnerable to damage from earthquakes. Our primary manufacturing facility in Wilsonville, Oregon is vulnerable to extreme heat and wildfires, as well as damage from earthquakes. An earthquake or other natural disaster or power shortages or outages could disrupt operations or impair critical systems at our headquarters or at any of our other facilities throughout the world. We, our suppliers, third-party service providers and customers are vulnerable to damage from natural disasters, including fire, floods or monsoons, power loss, communications failures, public health crises, such as pandemics and epidemics, political crises, such as terrorism, war, political instability or other conflict and similar events. If any disaster were to occur, our ability to operate our business at any of our facilities could be seriously, or potentially completely, impaired. In addition, the nature of our activities could cause significant delays in our research programs and commercial activities and make it difficult for us to recover from a disaster. The insurance we maintain may not be adequate to cover our losses resulting from disasters or other business interruptions. Accordingly, an earthquake or other disaster could materially and adversely harm our ability to conduct business. Furthermore, our in vivo antibody discovery services involve mice. In the past, vivarium sites have been shut down by animal activists, and any disturbance or shut down at the site where our in vivo antibody discovery work is being conducted could disrupt our business operations or harm our reputation.

Delivery of our products could be delayed or disrupted by factors beyond our control, and we could lose customers as a result.

We rely on third-party carriers for the timely delivery of our products. As a result, we are subject to carrier disruptions and increased costs that are beyond our control, including travel restrictions, employee strikes, inclement weather and increased fuel costs. Any failure to deliver products to our customers in a timely and accurate manner may damage our reputation and brand and could cause us to lose customers. If our relationship with any of these third-party carriers is terminated or impaired or if any of these third parties are unable to deliver our products, the delivery and acceptance of our products by our customers may be delayed which could harm our business and financial results. The failure to deliver our products in a timely manner may harm our relationship with our customers, increase our costs and otherwise disrupt our operations.

Doing business internationally creates operational and financial risks for our business.

During our fiscal years ended September 30, 2023, 2022 and 2021, 40%, 41% and 42%, respectively, of our revenue was generated from customers located outside of the United States. In connection with our growth strategy, we intend to further expand in international markets. Conducting and launching operations on an international scale requires close coordination of activities across multiple jurisdictions and time zones and consumes significant management resources. If we fail to coordinate and manage these activities effectively, our business, financial condition or results of operations could be adversely affected. International sales entail a variety of risks, including longer payment cycles and difficulties in collecting accounts receivable outside of the United States, currency exchange fluctuations, challenges in staffing and managing foreign operations, tariffs and other trade barriers (including tariffs enacted and proposed by the U.S. government on various imports from China and by the Chinese government on certain U.S. goods), unexpected changes in legislative or regulatory requirements of foreign countries into which we sell our products, difficulties in obtaining export licenses or in overcoming other trade barriers, laws and business practices favoring local companies, political instability, including conflicts and tensions involving Russia and China and the Israel-Hamas war, economic instability, difficulties protecting or procuring intellectual property rights, and restrictions resulting in delivery delays and significant taxes or other burdens of complying with a variety of foreign laws.

Changes in the value of the relevant currencies may affect the cost of certain items required in our operations. Changes in currency exchange rates may also affect the relative prices at which we are able to sell products in the same market. Our

revenue from international customers may be negatively impacted as increases in the U.S. dollar relative to our international customers' local currency could make our products more expensive, impacting our ability to compete. Our costs of materials from international suppliers may increase if in order to continue doing business with us they raise their prices as the value of the U.S. dollar decreases relative to their local currency. Foreign policies and actions regarding currency valuation could result in actions by the United States and other countries to offset the effects of such fluctuations. The recent global financial downturn has led to a high level of volatility in foreign currency exchange rates and that level of volatility may continue, which could adversely affect our business, financial condition or results of operations.

Our ability to use our net operating loss carryforwards to offset future taxable income may be subject to certain limitations.

In general, under Section 382 of the Internal Revenue Code of 1986, as amended, or the Code, a corporation that undergoes an "ownership change" is subject to limitations on its ability to use its pre-change net operating loss carryforwards, or NOLs, to offset future taxable income. We have experienced at least one ownership change in the past, and we may experience ownership changes in the future. Future changes in our stock ownership, some of which are outside of our control, could result in an ownership change under Section 382 of the Code. Furthermore, our ability to use NOLs of companies that we may acquire in the future may be subject to limitations. For these reasons, we may not be able to use a material portion of the NOLs reflected on our balance sheet, even if we attain profitability.

The enactment of legislation implementing changes in taxation of international business activities, the adoption of other corporate tax reform policies, or changes in tax legislation or policies could impact our future financial position and results of operations.

Corporate tax reform, base-erosion efforts and tax transparency continue to be high priorities in many tax jurisdictions where we intend to have business operations. As a result, policies regarding corporate income and other taxes in numerous jurisdictions are under heightened scrutiny and tax reform legislation is being proposed or enacted in a number of jurisdictions. For example, the Tax Cuts and Jobs Act of 2017, or the Tax Act, signed into law on December 22, 2017, adopting broad U.S. corporate income tax reform, among other things, reduced the U.S. corporate income tax rate, but imposed base-erosion prevention measures on non-U.S. earnings of U.S. entities as well as a one-time mandatory deemed repatriation tax on accumulated non-U.S. earnings of U.S. entities.

In addition, many countries are beginning to implement legislation and other guidance to align their international tax rules with the Organization for Economic Co-operation and Development's Base Erosion and Profit Shifting recommendations and action plan that aim to standardize and modernize global corporate tax policy, including changes to cross-border tax, transfer-pricing documentation rules, and nexus-based tax incentive practices.

Such legislative initiatives may materially and adversely affect our plans to expand internationally and may negatively impact our financial condition and results of operations generally.

Our inability to collect on our accounts receivable by a significant number of customers may have an adverse effect on our business, financial condition and results of operations.

Sales to our customers are generally made on open credit terms. Management maintains an allowance for potential credit losses. If our customers' cash flow, working capital, financial conditions or results of operations deteriorate, they may be unable or even unwilling to pay trade receivables owed to us promptly or at all. As a result, we could be exposed to a certain level of credit risk. If a major customer experiences, or a significant number of customers experience, financial difficulties, the effect on us could be material and have an adverse effect on our business, financial condition and results of operations.

We are subject to risks associated with COVID-19.

As discussed in further detail above, our global operations expose us to risks associated with COVID-19. While our financial results for the year ended September 30, 2023 have not been significantly affected by continuing COVID-19 outbreaks, impacts from COVID-19 may, in the future, adversely affect our operations, supply chains, distribution systems and customer demand, including as a result of impacts associated with preventive and precautionary measures that we, other businesses and governments have taken and may take. Some of the risks we have experienced and/or may experience in the future as a result of impacts from COVID-19 include:

- A decline in sales activities and customer orders or cancellations of existing orders, depending on the severity and duration of any future COVID-19 outbreaks and the extent of mitigation and containment measures that may be undertaken by governments and businesses.

- In addition to travel restrictions, while countries in general have re-opened their borders to U.S. travelers, and, in the future countries may again impose or expand travel restrictions and impose or resume prolonged quarantines if there is a resurgence of COVID-19 cases, which would significantly impact our ability to support our business operations and customers in those locations and the ability of our employees to access their places of work to produce products, or significantly hamper our products from moving through the supply chain.

As a result, given the uncertainty of the evolving nature of the virus, the COVID-19 outbreaks may continue and may negatively affect our revenue growth, and it is uncertain how materially COVID-19 will affect our global operations if we experience any one or a combination of these impacts over an extended period of time. Any of these impacts would have an adverse effect on our business, financial condition and results of operations. In addition, our ability to raise capital in the future may also be negatively affected.

Risks related to being a public company

If we fail to maintain proper and effective internal controls, our ability to produce accurate financial statements on a timely basis could be impaired, which would adversely affect our business.

As a public company, we are required to comply with Section 404 of the Sarbanes Oxley Act of 2002 ("SOX"), which requires, among other things, that companies maintain disclosure controls and procedures to ensure timely disclosure of material information, and that management review the effectiveness of those controls on a quarterly basis and that our independent registered public accounting firm provide an attestation report on the effectiveness of our internal control over financial reporting in this Annual Report on Form 10-K, among other additional requirements. Effective internal controls are necessary for us to provide reliable financial reports and to help prevent fraud, and our management and other personnel devote a substantial amount of time to these compliance requirements. These rules and regulations also increase our legal and financial compliance costs and make some activities more time-consuming and costly.

As disclosed in Part II—Item 9A, "Controls and Procedures", of this Annual Report on Form 10-K, we identified a material weakness in our internal control over financial reporting related to controls surrounding our information technology general controls. As this material weakness continued during the fiscal year ended September 30, 2023, management concluded that our internal control over financial reporting was not effective as of September 30, 2023. A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement in a company's annual or interim financial statements will not be prevented or detected on a timely basis. The material weakness identified in Item 9A in this Annual Report on Form 10-K did not result in any misstatement of our financial statements for any period presented. We have designed and are implementing a remediation plan for the material weakness. However, our remediation efforts may be inadequate, and we may in the future discover other areas of our internal controls that require remediation.

We cannot be certain that we will be able to maintain adequate controls over our financial processes and reporting in the future. If we fail to maintain effective internal controls, investors may lose confidence in the accuracy and completeness or our financial reports, the market price of our securities may be negatively affected, and we could be subject to sanctions or investigation by regulatory authorities, such as the SEC or Nasdaq.

The requirements of being a public company may strain our resources and require a substantial amount of management's attention.

As a public company, we are subject to the reporting requirements of the Exchange Act, the Sarbanes-Oxley Act, the Dodd-Frank Wall Street Reform and Consumer Protection Act, or the Dodd-Frank Act, Nasdaq listing requirements and other applicable securities rules and regulations. The SEC and other regulators have continued to adopt new rules and regulations and make additional changes to existing regulations that require our compliance. Stockholder activism, the current political environment, and the current high level of government intervention and regulatory reform may lead to substantial new regulations and disclosure obligations, which may lead to additional compliance costs and impact, in ways we cannot currently anticipate, the manner in which we operate our business. Compliance with these rules and regulations may cause us to incur additional accounting, legal and other expenses. We also incur costs associated with corporate governance requirements, including requirements under securities laws, as well as rules and regulations implemented by the SEC and Nasdaq, particularly as a large accelerated filer. These rules and regulations have increased our legal and financial compliance costs and we devote significant time to comply with these requirements. We are currently evaluating and monitoring developments with respect to these rules and regulations, and we cannot predict or estimate the amount of additional costs we may incur or the timing of such costs.

Risks related to our intellectual property

Our ability to protect our intellectual property and proprietary technology through patents and other means is uncertain.

Our commercial success depends in part on our ability to protect our intellectual property and proprietary technologies. We rely on patent protection, where appropriate and available, as well as a combination of copyright, trade secret and trademark laws, and nondisclosure, confidentiality and other contractual restrictions to protect our proprietary technology. However, these legal means afford only limited protection and may not adequately protect our rights or permit us to gain or keep any competitive advantage.

Worldwide, we own or exclusively in-license over 50 issued or allowed patents and more than 400 pending patent applications as of September 30, 2023. In addition to these owned and exclusively licensed patents and pending patent applications, we also license patents on a non-exclusive and/or territory restricted basis. Our intellectual property portfolio includes important patents and patent applications directed to DNA synthesis, Next Generation Sequencing, antibody libraries, and DNA data storage.

Several patent applications covering our technologies have been filed recently. We cannot offer any assurances about which, if any, patents will issue, the breadth of any such patent, or whether any issued patents will be found invalid and unenforceable or will be threatened by third parties. Any successful opposition to these patents or any other patents owned by or, if applicable in the future, licensed to us could deprive us of rights necessary for the practice of our technologies or the successful commercialization of products that we may develop. Since patent applications in the United States and most other countries are confidential for a period of time after filing, we cannot be certain that we were the first to file any patent application related to our technologies or products. Furthermore, an interference proceeding can be provoked by a third party or instituted by the U.S. Patent and Trademark Office ("USPTO"), or the European Patent Office ("EPO"), to determine who was the first to invent any of the subject matter covered by the patent claims of our applications. For example, on March 3, 2021, our European Patent No. 3030682 which relates to polynucleotide synthesis was opposed by an anonymous third party. An initial decision to revoke the patent was issued on November 29, 2022, which will not become final until all appeals are exhausted. We believe the EPO's decision relating to the original claims is erroneous and we appealed the EPO’s decision on January 27, 2023 while continuing to prosecute related pending European applications.

Patent law can be highly uncertain and involve complex legal and factual questions for which important principles remain unresolved. In the United States and in many international jurisdictions, policy regarding the breadth of claims allowed in patents can be inconsistent. The U.S. Supreme Court and the Court of Appeals for the Federal Circuit have made, and will likely continue to make, changes in how the patent laws of the United States are interpreted. Similarly, international courts have made, and will likely continue to make, changes in how the patent laws in their respective jurisdictions are interpreted. We cannot predict future changes in the interpretation of patent laws or changes to patent laws that might be enacted into law by U.S. and international legislative bodies.

If we are unable to obtain, maintain and enforce intellectual property protection, others may be able to make, use, or sell products and technologies substantially the same as ours, which could adversely affect our ability to compete in the market.

We may not pursue or maintain patent protection for our products in every country or territory in which we sell our products and technologies. In addition, our pending U.S. and foreign patent applications may not issue as patents or may not issue in a form that will be sufficient to protect our proprietary technology and gain or keep our competitive advantage. Any patents we have obtained or do obtain may be subject to re-examination, reissue, opposition or other administrative proceedings, or may be challenged in litigation, and such challenges could result in a determination that the patent is invalid or unenforceable.

Patents have a limited lifespan. Patent terms may be shortened or lengthened by, for example, terminal disclaimers, patent term adjustments, supplemental protection certificates, and patent term extensions. Although extensions may be available, the life of a patent, and the protection it affords, is limited. Patent term extensions and supplemental protection certificates, and the like, may be impacted by the regulatory process and may not significantly lengthen patent term. Non-payment or delay in payment of patent fees or annuities, delay in patent filings or delay in extension filing, whether intentional or unintentional, may also result in the loss of patent rights important to our business. In such an event, competitors might be able to enter the market earlier than would otherwise have been the case. In addition, certain countries have compulsory licensing laws under which a patent owner may be compelled to grant licenses to other parties. Furthermore, many countries limit the enforceability of patents against other parties, including government agencies or government contractors. In these countries, the patent owner may have limited remedies, which could materially diminish the value of any patents.

We cannot be certain that the steps we have taken will prevent unauthorized use or unauthorized reverse engineering of our technology. In addition, competitors may be able to design alternative methods or devices that avoid infringement of our patents. To the extent our intellectual property, including licensed intellectual property, offers inadequate protection, or is found to be invalid or unenforceable, we are exposed to a greater risk of direct competition. If our intellectual property does not provide adequate protection against our competitors' products, our competitive position could be adversely affected, as could our business. Both the patent application process and the process of managing patent disputes can be time consuming and expensive.

Monitoring unauthorized use of our intellectual property is difficult and costly. From time to time, we review our competitors' products, and may in the future seek to enforce our patents or other rights against potential infringement. However, the steps we have taken to protect our proprietary rights may not be adequate to prevent misappropriation of our intellectual property. We may not be able to detect unauthorized use of, or take appropriate steps to enforce, our intellectual property rights. We cannot guarantee that any of our patent searches or analyses, including but not limited to the identification of relevant patents, the scope of patent claims or the expiration of relevant patents, are complete or thorough, nor can we be certain that we have identified each and every third-party patent and pending application in the United States and abroad that is relevant to or necessary for the commercialization of our products in any jurisdiction. For example, U.S. applications filed before November 29, 2000 and certain U.S. applications filed after that date that will not be filed outside the United States remain confidential until patents issue. Patent applications in the United States and elsewhere are published approximately 18 months after the earliest filing for which priority is claimed. Therefore, patent applications covering our product candidates or technologies could have been filed by others without our knowledge. Additionally, pending patent applications that have been published can, subject to certain limitations, be later amended in a manner that could cover our platform technologies, our products or the use of our products or technologies. The scope of a patent claim is determined by the interpretation of the law, the written disclosure in a patent and the patent's prosecution history. Our interpretation of the relevance or the scope of a patent or a pending application may be incorrect, which may negatively impact our ability to market our products. We may incorrectly determine that our products are not covered by a third-party patent or may incorrectly predict whether a third party's pending application will issue with claims of relevant scope. Our determination of the expiration date of any patent in the United States or abroad that we consider relevant may be incorrect, which may negatively impact our ability to develop and market our product candidates.

A court or other judicial body may decide that the patent we seek to enforce is invalid or unenforceable or may refuse to stop the other party from using the technology at issue on the grounds that the patent in question does not cover the technology in question. An adverse result in any litigation could put one or more of our patents at risk of being invalidated or interpreted narrowly. Some of our competitors may be able to devote significantly more resources to intellectual property litigation and may have significantly broader patent portfolios to assert against us if we assert our rights against them.

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

Filing, prosecuting and defending patents on our technologies and products in all countries throughout the world would be prohibitively expensive. In addition, the laws of some non-U.S. countries do not protect intellectual property rights to the same extent as the laws of the United States, and many companies have encountered significant problems in protecting and defending such rights in foreign jurisdictions. Consequently, we may not be able to prevent third parties from using our inventions in countries outside the United States, or from selling or importing products made using our inventions in and into the United States or other jurisdictions. Competitors may use our technologies in jurisdictions where we have not obtained patent protection to develop their own technologies and products and, may export otherwise infringing products to territories where we have patent protection. These products may compete with our products, and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

The legal systems of certain countries, particularly China and certain other developing countries, do not favor the enforcement of patents and other intellectual property protection, particularly those relating to biotechnology, which could make it difficult for us to stop the infringement of our patents. Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial cost and divert our efforts and attention from other aspects of our business, put our own patents at risk of being invalidated or interpreted narrowly, put our patent applications at risk of not being issued, and provoke third parties to assert claims against us. We may not prevail in any lawsuits that we initiate, and the damages or other remedies awarded, if any, may not be commercially meaningful. Accordingly, our efforts to enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop. Certain countries in Europe and developing countries, including China and India, have compulsory licensing laws under which a patent owner may be compelled to grant licenses to third parties. In those countries, we may have limited remedies if any of our patents are infringed or if we are compelled to grant a license to a third party, which could materially diminish the value of those patents. This could limit our potential revenue opportunities.

Accordingly, our efforts to enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or license.

If we are unable to protect the confidentiality of our proprietary information and know-how, the value of our technology and products could be adversely affected.

In addition to pursuing patents on our technology, we take steps to protect our intellectual property and proprietary technology by entering into confidentiality agreements and intellectual property assignment agreements with our employees, consultants, corporate partners and, when needed, our advisors. Such agreements may not be enforceable or may not provide meaningful protection for our trade secrets or other proprietary information in the event of unauthorized use or disclosure or other breaches of the agreements, and we may not be able to prevent such unauthorized disclosure. Monitoring unauthorized disclosure is difficult, and we do not know whether the steps we have taken to prevent such disclosure are, or will be, adequate. If we were to enforce a claim that a third party had illegally obtained and was using our trade secrets, it would be expensive and time consuming, and the outcome would be unpredictable. In addition, courts outside the United States may be less willing to protect trade secrets.

Trade secrets and know-how can be difficult to protect as trade secrets, and know-how will over time be disseminated within the industry through independent development, the publication of journal articles, and the movement of personnel skilled in the art from company to company. In addition, because we may rely on third parties in the development of our products, we may, at times, share trade secrets with them. We seek to protect our proprietary technology in part by entering into confidentiality agreements and, if applicable, material transfer agreements, consulting agreements or other similar agreements with third parties prior to beginning research or disclosing proprietary information. These agreements typically limit the rights of the third parties to use or disclose our confidential information, including our trade secrets. Despite the contractual provisions employed when working with third parties, the need to share trade secrets and other confidential information increases the risk that such trade secrets become known by our competitors, are inadvertently incorporated into the technology of others, or are disclosed or used in violation of these agreements. If we are unable to prevent unauthorized material disclosure of the intellectual property related to our technologies to third parties, we will not be able to establish or maintain a competitive advantage in our market, which could materially adversely affect our business, results of operations and financial condition.

Despite our efforts to protect our trade secrets, our competitors may discover our trade secrets, either lawfully or through breach of our agreements with third parties, independent development or publication of information by any of our third-party collaborators. Competitors could willfully infringe our intellectual property rights, design around our protected technology or develop their own competitive technologies that fall outside of our intellectual property rights. In addition, if any of our trade secrets were to be lawfully obtained or independently developed by a competitor, we would have no right to prevent such competitor from using that technology or information to compete with us, which could harm our competitive position. Given that our proprietary position is based, in part, on our know-how and trade secrets, a competitor's discovery of our trade secrets or other unauthorized use or disclosure would impair our competitive position and may have an adverse effect on our business and results of operations.

We may be involved in lawsuits to protect or enforce our patents and proprietary rights, to determine the scope, coverage and validity of others' proprietary rights, or to defend against third party claims of intellectual property infringement that could require us to spend significant time and money and could prevent us from selling our products or impact our stock price.

Litigation may be necessary for us to enforce our patent and proprietary rights and/or to determine the scope, coverage and validity of others' proprietary rights. Litigation on these matters has been prevalent in our industry and we expect that this will continue. As the biotechnology and synthetic biology industries expand and more patents are issued, the risk increases that there may be patents issued to third parties that relate to our technologies and products of which we are not aware or that we may need to challenge to continue our operations as currently contemplated. In addition, our competitors and others may have patents or may in the future obtain patents and claim that the use of our products or processes infringes these patents. As we move into new markets and applications for our products and processes, incumbent participants in such markets may assert their patents and other proprietary rights against us as a means of slowing our entry into such markets or as a means to extract substantial license and royalty payments from us.

Patent infringement suits can be expensive, lengthy and disruptive to business operations and the outcome following legal assertions of invalidity and unenforceability is unpredictable. We could incur substantial costs and divert the attention of our management and technical personnel in prosecuting or defending against any claims and may harm our reputation. Some of our competitors may be able to sustain the costs of complex patent litigation more effectively than we can because they have substantially greater resources. There can be no assurance that we will prevail in any suit initiated against us by third parties, successfully settle or otherwise resolve patent infringement claims. If we are unable to successfully settle

claims on terms acceptable to us, we may be required to engage in or continue costly, unpredictable and time-consuming litigation and may be prevented from or experience substantial delays in marketing our technologies and products. Furthermore, parties making claims against us may be able to obtain injunctive or other relief, which could block our ability to develop, commercialize and sell products, and could result in the award of substantial damages against us, including treble damages and attorneys' fees and costs in the event that we are found to be a willful infringer of third party patents.

In the event of a successful claim of infringement against us, we may be required to obtain one or more licenses from third parties, which we may not be able to obtain at a reasonable cost, if at all. We could therefore incur substantial costs related to royalty payments for licenses obtained from third parties, which could negatively affect our gross margins. In addition, we could encounter delays in product introductions while we attempt to develop alternative methods or products to avoid infringing third-party patents or proprietary rights. Defense of any lawsuit or failure to obtain any required licenses on favorable terms could prevent us from commercializing our products, and the risk of a prohibition on the sale of any of our products could adversely affect our ability to grow and gain market acceptance for our products.

Suppliers of certain equipment and technology platforms on which we rely for our business may also be subject to patent infringement lawsuits. Even if we are not a named party in such lawsuits, if such suppliers are enjoined by a court to stop selling their equipment and technology platforms or supporting our existing equipment and technology platforms, we may not have an alternative source for such equipment and technology platforms, which may have a material adverse effect on our business.

We may also be subject to claims that former employees, collaborators or other third parties have an ownership interest in our patents or other intellectual property. We were previously involved in litigation of this kind with Agilent. While we have settled this dispute, there can be no assurance that future litigation will not be initiated by these parties. Some of our employees were previously employed at universities or biotechnology or biopharmaceutical companies, including our competitors or potential competitors. We may be subject to claims that these employees or we have inadvertently or otherwise used or disclosed trade secrets or other proprietary information of their former employers. Litigation may be necessary to defend against these and other claims challenging inventorship or ownership. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights. A loss of key research personnel or their work product could hamper our ability to commercialize, or prevent us from commercializing, our products and technologies. Such an outcome could have a material adverse effect on our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and distraction to management and other employees.

Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation. In addition, during the course of this kind of litigation, there could be public announcements of the results of hearings, motions or other interim proceedings or developments. 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. Such litigation or proceedings could substantially increase our operating losses and reduce the resources available for development activities or any future sales, marketing or distribution activities. Finally, any uncertainties resulting from the initiation and continuation of any litigation could have a material adverse effect on our ability to raise the funds necessary to continue our operations.

In addition, our agreements with some of our suppliers, distributors, customers and other entities with whom we do business may require us to defend or indemnify these parties to the extent they become involved in infringement claims against us, including the claims described above. We could also voluntarily agree to defend or indemnify third parties in instances where we are not obligated to do so if we determine it would be important to our business relationships. If we are required or agree to defend or indemnify any of these third parties in connection with any infringement claims, we could incur significant costs and expenses that could adversely affect our business, operating results, or financial condition.

We may not be successful in obtaining or maintaining necessary rights to our products and technologies through acquisitions and in-licenses, and our intellectual property agreements with third parties may involve unfavorable terms or be subject to disagreements over contract interpretation.

We may find that our programs require the use of proprietary rights held by third parties, and the growth of our business may depend in part on our ability to acquire, in-license or use these proprietary rights. We may be unable to acquire or in-license compositions, methods of use, processes or other third-party intellectual property rights from third parties that we identify as necessary for our products and technologies. The licensing and acquisition of third-party intellectual property rights is a competitive area, and other companies may also be pursuing strategies to license or acquire third-party intellectual property rights that we may consider attractive. These companies may have a competitive advantage over us due to their size, financial resources and greater commercialization capabilities. In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to us. Moreover, collaboration arrangements are complex and

time-consuming to negotiate, document, implement and maintain. We may not be successful in our efforts to establish and implement collaborations or other alternative arrangements should we so choose to enter into such arrangements. We also may be unable to license or acquire third-party intellectual property rights on terms that would be favorable to us or would allow us to make an appropriate return on our investment.

We engage in discussions regarding other possible commercial and cross-licensing agreements with third parties from time to time. There can be no assurance that these discussions will lead to the execution of commercial license or cross-license agreements or that such agreements will be on terms that are favorable to us. Even if we are able to obtain a license to intellectual property of interest, we may not be able to secure exclusive rights, in which case others could use the same rights and compete with us. In addition, if we enter into cross-licensing agreements, there is no assurance that we will be able to effectively compete against others who are licensed under our patents.

In addition, provisions in our licensing and other intellectual property agreements may be susceptible to multiple interpretations. The resolution of any contract interpretation disagreement that may arise could affect the scope of our rights to the relevant intellectual property or technology or affect financial or other obligations under the relevant agreement, either of which could have a material adverse effect on our business, financial condition, results of operations and prospects.

We have not yet registered some of our trademarks in all of our potential markets, and failure to secure those registrations could adversely affect our business.

Some of our trademark applications may not be allowed for registration, and our registered trademarks may not be maintained or enforced. In addition, in the U.S. Patent and Trademark Office and in comparable agencies in many foreign jurisdictions, third parties are given an opportunity to oppose pending trademark applications and to seek to cancel registered trademarks. Opposition or cancellation proceedings may be filed against our trademarks, and our trademarks may not survive such proceedings.

In addition, third parties may file first for our trademarks in certain countries. If they succeed in registering such trademarks, and if we are not successful in challenging such third-party rights, we may not be able to use these trademarks for marketing our products and technologies in those countries. Over the long-term, if we are unable to establish name recognition based on our trademarks, then our marketing abilities may be materially adversely impacted.

We depend on certain technologies that are licensed to us. We do not control these technologies and any loss of our rights to them could prevent us from selling our products.

We rely on, or may in the future rely on, licenses in order to be able to use various proprietary technologies that are material to our business. We do not or will not own the patents that underlie these licenses. Our rights to use the technology we license are subject to the negotiation of, continuation of and compliance with the terms of those licenses. In some cases, we do not or will not control the prosecution, maintenance, or filing of the patents to which we hold licenses, or the enforcement of these patents against third parties. Some of our patents and patent applications were either acquired from another company who acquired those patents and patent applications from yet another company or are licensed from a third party. For example, Twist Bioscience acquired Genome Compiler Corporation in 2016, and Genome Compiler had a non-exclusive license to U.S. Patent No- 7,805,252 owned by DNA 2.0. Thus, these patents and patent applications are not written by us or our attorneys, and we did not have control over the drafting and prosecution. The former patent owners and our licensors might not have given the same attention to the drafting and prosecution of these patents and applications as we would have if we had been the owners of the patents and applications and had control over the drafting and prosecution. We cannot be certain that drafting and/or prosecution of the licensed patents and patent applications by the licensors have been or will be conducted in compliance with applicable laws and regulations or will result in valid and enforceable patents and other intellectual property rights.

Our rights to use the technology we license is subject to the validity of the owner's intellectual property rights. Enforcement of our licensed patents or defense or any claims asserting the invalidity of these patents is often subject to the control or cooperation of our licensors. Legal action could be initiated against the owners of the intellectual property that we license. Even if we are not a party to these legal actions, an adverse outcome could harm our business because it might prevent these other companies or institutions from continuing to license intellectual property that we may need to operate our business.

Our licenses contain or will contain provisions that allow the licensor to terminate the license upon specific conditions. Our rights under the licenses are subject to or will be subject to our continued compliance with the terms of the license, including the payment of royalties due under the license. Termination of these licenses could prevent us from marketing some or all of our products. Because of the complexity of our products and the patents we have licensed, determining the scope of the license and related royalty obligation can be difficult and can lead to disputes between us and the licensor. An unfavorable resolution of such a dispute could lead to an increase in the royalties payable pursuant to the license. If a

licensor believed we were not paying the royalties due under the license or were otherwise not in compliance with the terms of the license, the licensor might attempt to revoke the license. If such an attempt were successful, we might be barred from producing and selling some or all of our products.

Risks relating to owning our common stock

We have never paid dividends on our capital stock and we do not intend to pay dividends for the foreseeable future. Consequently, any gains from an investment in our common stock will likely depend on whether the price of our common stock increases.

We have never declared or paid any dividends on our common stock and do not intend to pay any dividends in the foreseeable future. We anticipate that we will retain all of our future earnings for use in the operation of our business and for general corporate purposes. Any determination to pay dividends in the future will be at the discretion of our board of directors. Accordingly, investors must rely on sales of their common stock after any price appreciation as the only way to realize any future gains on their investments.

Our charter documents and Delaware law could prevent a takeover that stockholders consider favorable and could also reduce the market price of our stock.

Our amended and restated certificate of incorporation and our amended and restated bylaws contain provisions that could delay or prevent a change in control of our company. These provisions could also make it more difficult for stockholders to elect directors and take other corporate actions. These provisions include:

- providing for a classified board of directors with staggered, three-year terms;
- authorizing our board of directors to issue preferred stock with voting or other rights or preferences that could discourage a takeover attempt or delay changes in control;
- prohibiting cumulative voting in the election of directors;
- providing that vacancies on our board of directors may be filled only by a majority of directors then in office, even though less than a quorum;
- prohibiting the adoption, amendment or repeal of our amended and restated bylaws or the repeal of the provisions of our amended and restated certificate of incorporation regarding the election and removal of directors without the required approval of at least 66.67% of the shares entitled to vote at an election of directors;
- prohibiting stockholder action by written consent;
- limiting the persons who may call special meetings of stockholders; and
- requiring advance notification of stockholder nominations and proposals.

These provisions may frustrate or prevent any attempts by our stockholders to replace or remove our current management by making it more difficult for stockholders to replace members of our board of directors, which is responsible for appointing the members of our management. In addition, the provisions of Section 203 of the Delaware General Corporate Law, or the DGCL, govern us. These provisions may prohibit large stockholders, in particular those owning 15% or more of our outstanding voting stock, from merging or combining with us for a certain period of time without the consent of our board of directors.

These and other provisions in our amended and restated certificate of incorporation and our amended and restated bylaws and under Delaware law could discourage potential takeover attempts, reduce the price investors might be willing to pay in the future for shares of our common stock and result in the market price of our common stock being lower than it would be without these provisions.

Our amended and restated certificate of incorporation provides that the Court of Chancery of the State of Delaware and the federal district courts of the United States will be the exclusive forum for substantially all disputes between us and our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us or our directors, officers or other employees.

Our amended and restated certificate of incorporation provides that the Court of Chancery of the State of Delaware is the sole and exclusive forum for any derivative action or proceeding brought on our behalf, any action asserting a breach of fiduciary duty owed by any of our directors, officers or other employees to us or our stockholders, any action asserting a

claim against us arising pursuant to any provisions of the DGCL, our amended and restated certificate of incorporation or our amended and restated bylaws, any action or proceeding asserting a claim as to which the Delaware General Corporation Law confers jurisdiction upon the Court of Chancery of the State of Delaware or any action asserting a claim against us that is governed by the internal affairs doctrine, subject in each case to the Court of Chancery having personal jurisdiction over the parties named as defendants therein. The exclusive forum provision will not apply to suits brought to enforce any liability or duty created by the Exchange Act or any other claim for which the federal courts have exclusive jurisdiction. The choice of forum provision may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or other employees, which may discourage such lawsuits against us and our directors, officers and other employees. If a court were to find the choice of forum provision contained in our amended and restated certificate of incorporation to be inapplicable or unenforceable in an action, we might incur additional costs associated with resolving such action in other jurisdictions.

In addition, our amended and restated certificate of incorporation provides that the U.S. federal district courts are the exclusive forum for the resolution of any complaint asserting a cause of action arising under the Securities Act. Our exclusive forum provision will not relieve us of our duties to comply with the federal securities laws and the rules and regulations thereunder, and our stockholders will not be deemed to have waived our compliance with these laws, rules and regulations.

The enforceability of similar federal court choice of forum provisions in other companies' certificates of incorporation has been challenged in legal proceedings, and it is possible that a court could find our federal court choice of forum provision to be inapplicable or unenforceable. If a court were to find either of the choice of forum provisions contained in our amended and restated certificate of incorporation to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions. Additionally, while the Delaware Supreme Court recently determined that choice of forum provisions for actions arising under the Securities Act are facially valid, a stockholder may nevertheless seek to bring such a claim arising under the Securities Act against us, our directors, officers, or other employees in a venue other than in the federal district courts of the United States. In such instance, we would expect to vigorously assert the validity and enforceability of the exclusive forum provisions of our amended and restated certificate of incorporation, and this may require significant additional costs associated with resolving such action in other jurisdictions.

General risk factors

The market price of our common stock is likely to be volatile and could fluctuate or decline, resulting in a substantial loss of your investment.

The market price of our common stock could be subject to wide fluctuations in response to, among other things, the factors described in this "Risk factors" section or otherwise, and other factors beyond our control, such as fluctuations in the valuations of companies perceived by investors to be comparable to us.

Furthermore, the stock markets have experienced price and volume fluctuations that have affected and continue to affect the market prices of equity securities of many companies. These fluctuations often have been unrelated or disproportionate to the operating performance of those companies. These broad market fluctuations, as well as general economic, systemic, political and market conditions, such as recessions, interest rate changes or international currency fluctuations, may negatively affect the market price of our common stock.

Factors that could cause the market price of our common stock to fluctuate significantly include:

- actual or anticipated fluctuations in our financial condition and operating results, including fluctuations in our quarterly and annual results;
- announcements of technological innovations by us or our competitors;
- overall conditions in our industry and the markets in which we operate;
- addition or loss of significant customers, or other developments with respect to significant customers;
- changes in laws or regulations applicable to our products;
- actual or anticipated changes in our growth rate relative to our competitors;
- announcements by us or our competitors of significant acquisitions, strategic partnerships, joint ventures or capital commitments;
- additions or departures of key personnel;
- operational impacts resulting from a reduction in force;
- competition from existing products or new products that may emerge;
- issuance of new or updated research or reports by securities analysts;
- fluctuations in the valuation of companies perceived by investors to be comparable to us;
- disputes or other developments related to proprietary rights, including patents, litigation matters and our ability to obtain intellectual property protection for our technologies;
- announcement or expectation of additional financing efforts;
- sales of our common stock by us or our stockholders;
- the addition or removal of our stock to or from a stock index fund;
- share price and volume fluctuations attributable to inconsistent trading volume levels of our shares;
- the expiration of contractual lock-up agreements with our executive officers, directors and stockholders, which we may enter into in the future from time to time;
- general economic and market conditions, including economic downturns or uncertainty in financial markets; and
- other factors beyond our control, such as terrorism, war, natural disasters and pandemics.

In the past, many companies that have experienced volatility in the market price of their stock have become subject to securities class action litigation. We are now and may in the future be the target of this type of litigation. Securities

litigation against us could result in substantial costs and divert our management's attention from other business concerns, which could harm our business.

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

The trading market for our common stock will depend on the research and reports that securities or industry analysts publish about us or our business and we will not have any control over such analysts. If one or more of the analysts who cover us downgrade our shares or change their opinion of our shares, our share price would likely decline. If one or more of these analysts cease coverage of our company or fail to regularly publish reports on us, we could lose visibility in the financial markets, which could cause our share price or trading volume to decline.

We have in the past and may in the future be subject to short selling strategies that may drive down the market price of our common stock.

Short sellers have in the past and may attempt in the future to drive down the market price of our common stock. Short selling is the practice of selling securities that the seller does not own but may have borrowed with the intention of buying identical securities back at a later date. The short seller hopes to profit from a decline in the value of the securities between the time the securities are borrowed and the time they are replaced. As it is in the short seller's best interests for the price of the stock to decline, many short sellers (sometime known as "disclosed shorts") publish, or arrange for the publication of, negative opinions regarding the relevant issuer and its business prospects to create negative market momentum. Although traditionally these disclosed shorts were limited in their ability to access mainstream business media or to otherwise create negative market rumors, the rise of the Internet and technological advancements regarding document creation, videotaping and publication by weblog ("blogging") have allowed many disclosed shorts to publicly attack a company's credibility, strategy and veracity by means of so-called "research reports" that mimic the type of investment analysis performed by large Wall Street firms and independent research analysts. These short attacks have, in the past, led to selling of shares in the market. Further, these short seller publications are not regulated by any governmental, self-regulatory organization or other official authority in the U.S. and they are not subject to certification requirements imposed by the SEC. Accordingly, the opinions they express may be based on distortions, omissions or fabrications. Companies that are subject to unfavorable allegations, even if untrue, may have to expend a significant amount of resources to investigate such allegations and/or defend themselves, including shareholder suits against the company that may be prompted by such allegations. We have been and may in the future be the subject of shareholder suits that we believe were prompted by allegations made by short sellers.

Future sales and issuances of our common stock or rights to purchase common stock, including pursuant to our equity incentive plans, could result in additional dilution of the percentage ownership of our stockholders and could cause the stock price of our common stock to decline.

As we have in the past, we may sell common stock, convertible securities or other equity securities in one or more transactions at prices and in a manner, we determine from time to time. We have also issued and expect to issue common stock to employees and directors pursuant to our equity incentive plans. If we sell common stock, convertible securities or other equity securities in future transactions, or common stock is issued pursuant to equity incentive plans, investors may be materially diluted. New investors in such subsequent transactions could gain rights, preferences and privileges senior to those of holders of our common stock.

Claims for indemnification by our directors and officers may reduce our available funds to satisfy successful third-party claims against us and may reduce the amount of money available to us.

Our amended and restated certificate of incorporation and amended and restated bylaws provide that we will indemnify our directors and officers, in each case to the fullest extent permitted by Delaware law.

In addition, as permitted by Section 145 of the DGCL, our amended and restated bylaws and our indemnification agreements that we have entered into with our directors and officers provide that:

- we will indemnify our directors and officers for serving us in those capacities or for serving other business enterprises at our request, to the fullest extent permitted by Delaware law, which provides that a corporation may indemnify such person if such person acted in good faith and in a manner such person reasonably believed to be in or not opposed to the best interests of the registrant and, with respect to any criminal proceeding, had no reasonable cause to believe such person's conduct was unlawful;

- we may, in our discretion, indemnify employees and agents in those circumstances where indemnification is permitted by applicable law;

- we are required to advance expenses, as incurred, to our directors and officers in connection with defending a proceeding, except that such directors or officers shall undertake to repay such advances if it is ultimately determined that such person is not entitled to indemnification;

- we will not be obligated pursuant to our amended and restated bylaws to indemnify a person with respect to proceedings initiated by that person against us or our other indemnitees, except with respect to proceedings authorized by our board of directors or brought to enforce a right to indemnification;

- the rights conferred in our amended and restated bylaws are not exclusive, and we are authorized to enter into indemnification agreements with our directors, officers, employees and agents and to obtain insurance to indemnify such persons; and

- we may not retroactively amend our amended and restated bylaw provisions to reduce our indemnification obligations to directors, officers, employees and agents.

Evolving expectations around corporate responsibility practices, specifically related to environmental, social and governance ("ESG") matters, may expose us to reputational and other risks.

Investors, stockholders, customers, suppliers and other third parties are increasingly focusing on ESG and corporate social responsibility endeavors and reporting. Certain institutional investors, investment funds, other influential investors, customers, suppliers and other third parties are also increasingly focused on ESG practices. Companies that do not adapt to or comply with the evolving investor or stakeholder expectations and standards, or which are perceived to have not responded appropriately, may suffer from reputational damage and result in the business, financial condition and/or stock price of a company being materially and adversely affected. Further, this increased focus on ESG issues may result in new regulations and/or third-party requirements that could adversely impact our business, or certain stockholders reducing or eliminating their holdings of our stock. Additionally, an allegation or perception that we have not taken sufficient action in these areas could negatively harm our reputation.

Item 1B. *Unresolved staff comments*

None.

Item 2. *Properties*

Our principal facilities are described below:

Principal Facilities	Approximate Square Footage	Lease Expiration	Use	Owned or Leased
Wilsonville, OR	211,995	2044	General & Administration and Manufacturing	Leased
South San Francisco, CA	91,791	2028	General & Administration, R&D and Manufacturing	Leased
Brisbane, CA	24,786	2026	Warehouse facility	Leased
Quincy, MA	38,853	2032	General & Administration, R&D and Manufacturing	Leased
Canton, MA	12,158	2025	R&D and Manufacturing	Leased
Guangzhou, China	11,583	2024	Office Space & Biopharma Services facility	Leased
Tel Aviv, Israel	9,332	2024	R&D (software development)	Leased
Carlsbad, CA	8,772	2026	Sales & Marketing	Leased
Shanghai, China	2,067	Monthly	Sales & Marketing	Leased
Singapore	1,353	2025	Sales & Marketing	Leased

The Company believes its existing facilities are in good operating condition and are suitable for the conduct of its business.

Item 3. *Legal proceedings*

For a description of material pending legal proceedings, see Note 6 "Commitments and Contingencies - Legal Proceedings" of the Notes to Condensed Consolidated Financial Statements included in Part II, Item 8 of this Annual Report on Form 10-K, which is incorporated herein by reference. In addition, we are subject to various legal proceedings and claims arising in the ordinary course of business. Although occasional adverse decisions or settlements may occur,

management believes that the final disposition of such matters will not have a material adverse effect on our business, financial position, results of operations or cash flows.

Item 4. ***Mine safety disclosures***

Not applicable.

PART II

Item 5. ***Market for registrant's common equity, related stockholder matters and issuer purchases of equity securities***

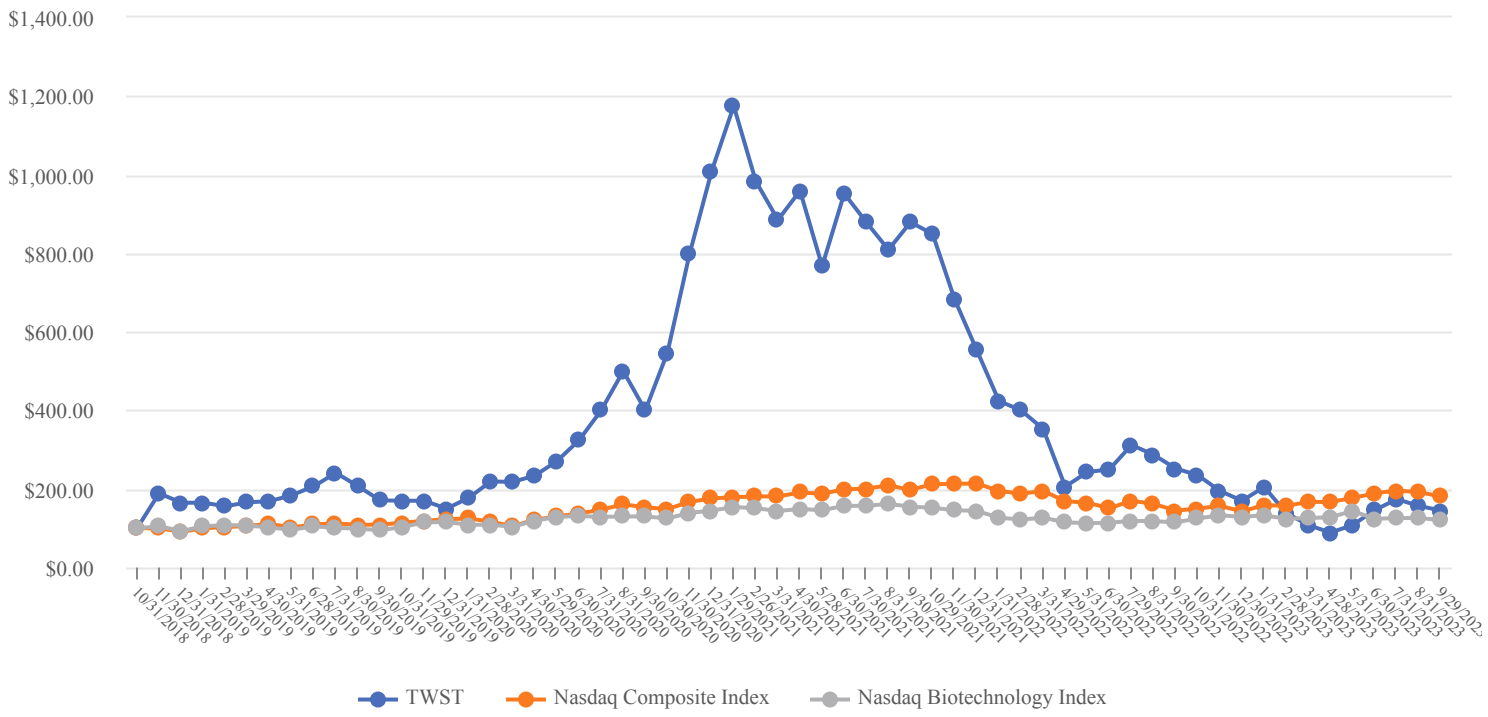
Market information for common stock

Our common stock began trading on The Nasdaq Global Market under the symbol "TWST" on October 31, 2018 in connection with the initial public offering of our common stock. Prior to that date, there was no public market for our common stock.

Performance Graph

This graph is not "soliciting material" or subject to Regulation 14A, deemed "filed" with the SEC for purposes of Section 18 of the Exchange Act, or otherwise subject to liabilities under that section, and shall not be deemed incorporated by reference into any filing of the Company under the Securities Act or the Exchange Act, whether made before or after the date hereof and irrespective of any general incorporation language in any such filing.

The following graph compares the cumulative total return to stockholder return on our common stock relative to the cumulative total returns of the Nasdaq Composite Index and the Nasdaq Biotechnology Index. An investment of $100 is assumed to have been made in our common stock and each index on October 31, 2018 (the first day of trading of our common stock) and its relative performance is tracked through September 30, 2023. Pursuant to applicable SEC rules, all values assume reinvestment of the full amount of all dividends; however, no dividends have been declared on our common stock to date. The stockholder returns shown on the graph below are based on historical results and are not necessarily indicative of future performance, and we do not make or endorse any predictions as to future stockholder returns.



* $100.00 invested on October 31, 2018 in stock or index, including reinvestment of dividends.

	12/31/2018	3/29/2019	6/28/2019	9/30/2019	12/31/2019	3/31/2020	6/30/2020	9/30/2020
Twist Bioscience Corporation	$ 165.00	$ 166.00	$ 207.00	$ 171.00	$ 150.00	$ 218.00	$ 324.00	$ 400.00
Nasdaq Composite Index	91.00	106.00	110.00	109.00	123.00	105.00	138.00	153.00
Nasdaq Biotechnology Index	93.00	107.00	105.00	95.00	116.00	104.00	131.00	130.00

	12/31/2020	3/31/2021	6/30/2021	9/30/2021	12/31/2021	3/31/2022	6/30/2022	9/30/2022
Twist Bioscience Corporation	$ 1,009.00	$ 885.00	$ 952.00	$ 879.00	$ 553.00	$ 353.00	$ 250.00	$ 252.00
Nasdaq Composite Index	176.00	181.00	199.00	198.00	214.00	195.00	151.00	145.00
Nasdaq Biotechnology Index	145.00	144.00	157.00	155.00	144.00	127.00	114.00	115.00

	12/31/2022	3/31/2023	6/30/2023	9/30/2023
Twist Bioscience Corporation	$ 170.00	$ 108.00	$ 146.00	$ 145.00
Nasdaq Composite Index	143.00	167.00	189.00	181.00
Nasdaq Biotechnology Index	129.00	126.00	124.00	121.00

Holders of Record

As of November 17, 2023, there were approximately 58 holders of record of our common stock. Because many of our shares of common stock are held by brokers and other institutions on behalf of stockholders, we are unable to estimate the total number of stockholders represented by these record holders.

Dividend Policy

We have never declared or paid, and do not anticipate declaring or paying in the foreseeable future, any cash dividends on our capital stock. Any future determination to declare cash dividends will be made at the discretion of our board of directors, subject to applicable laws, and will depend on our financial condition, results of operations, capital requirements, general business conditions and other factors that our board of directors may deem relevant.

Sales of unregistered securities

None.

Issuer Purchases of Equity Securities

None.

Item 6. [Reserved]

Item 7. *Management's discussion and analysis of financial condition and results of operations*

The following Management's Discussion and Analysis of Financial Condition and Results of Operations (MD&A) is intended to promote understanding of the results of operations and financial condition. The following discussion and analysis of our financial condition and results of operations should be read in conjunction with our consolidated financial statements and the related notes to those statements included elsewhere in this Form 10-K. In addition to historical financial information, the following discussion and analysis contains forward-looking statements that involve risks, uncertainties and assumptions. Our actual results and timing of selected events may differ materially from those anticipated in these forward-looking statements as a result of many factors, including those discussed under "Risk factors" and elsewhere in this Form 10-K. The last day of our fiscal year is September 30, and we refer to our fiscal year ended September 30, 2021 as fiscal year 2021 or 2021, September 30, 2022 as fiscal year 2022 or 2022 and our fiscal year ended September 30, 2023 as fiscal year 2023 or 2023.

Overview

We are an innovative synthetic biology and genomics company that has developed a scalable DNA synthesis platform to industrialize the engineering of biology. The core of our platform is a proprietary technology that pioneers a new method of manufacturing synthetic DNA by "writing" DNA on a silicon chip. We have miniaturized traditional chemical DNA synthesis reactions to write over one million short pieces of DNA on each silicon chip, approximately the size of a large mobile phone. We have combined this technology with proprietary software, scalable commercial infrastructure, and an e-commerce platform to create an integrated technology platform that enables us to achieve high levels of quality, precision, automation, and manufacturing throughput at a significantly lower cost than our competitors. We are leveraging our unique technology to manufacture a broad range of synthetic DNA based products, including synthetic genes, tools for next-generation sample preparation, and antibody libraries for drug discovery and development.

Additionally, we believe our platform will enable new value-added opportunities, such as discovery partnerships for biologic drugs, and will enable new applications for synthetic DNA, such as digital data storage. We sell our synthetic DNA and synthetic DNA-based products to a customer base of approximately 3,450 customers across a broad range of industries.

We launched the first application of our platform, synthetic genes and oligo pools, in April 2016 to disrupt the gene synthesis market and make legacy DNA synthesis methods obsolete.

We have grown rapidly and generated revenues of $245.1 million in the year ended September 30, 2023, $203.6 million in the year ended September 30, 2022 and $132.3 million in the year ended September 30, 2021, while incurring net losses of $204.6 million, $217.9 million and $152.1 million in the years ended September 30, 2023, 2022 and 2021, respectively. Since our inception, we have incurred significant operating losses and have accumulated net deficit of $1,033.0 million. To support our growth, we have resized our number of employees and increased investment in our manufacturing capabilities. Our ability to generate product revenue sufficient to achieve profitability will depend heavily on the success of our existing products and the development and commercialization of additional products in the synthetic biology, biologic drug and data storage industries, including our Express Genes product which we launched in the fall of 2023 as well as leveraging our investment in our manufacturing facility near Portland, Oregon.

In 2023, 2022 and 2021 we served approximately 3,450, 3,300 and 2,900 customers, respectively.

Highlights from fiscal year 2023 compared with fiscal year 2022 included:

- revenue growth of 20% to $245.1 million from $203.6 million in 2022, primarily due to order growth in NGS tools, synthetic genes and DNA libraries;
- the number of our genes shipped increasing from 558,000 in 2022 to 634,000; and
- implementing a strategic restructuring plan to reduce costs, build a leaner organization and increase operating efficiencies. The restructuring plan includes a reduction in force which affected approximately 270 employees worldwide, representing approximately 25% of the Company's total workforce. Furthermore, as part of the plan we removed the duplication of synthetic biology production across our South San Francisco, California and Wilsonville, Oregon facilities. The plan was implemented beginning in May 2023 and was substantially completed by the end of fiscal year 2023. Restructuring and other costs included employee severance and related benefit costs of $8.6 million, restructuring and non-restructuring related impairment of property and equipment of $6.8 million, and other costs associated with restructuring of $0.9 million.

We have built a scalable commercial platform that enables us to reach a diverse customer base in a variety of industries including industrial chemicals/materials, academic research, healthcare, food, agriculture and data storage. To address this diverse customer base, we have employed a multichannel strategy comprised of a direct sales force targeting synthetic DNA customers, international distributors, and an e-commerce platform. Launched in fiscal 2018, our e-commerce platform allows customers to design, validate and place on-demand orders of customized DNA online. This is a key component of our strategy to address and support our diverse and growing customer base, as well as support commercial productivity, enhance the customer experience, and promote loyalty.

Seasonality

Over the years, we have experienced a pattern, although not consistently, of our third-quarter revenue growth being lower than revenue growth in other quarters due to a decrease in demand from certain potentially significant customers during such quarter and periodic revenue fluctuations in our NGS tools. As we grow our NGS tools, our revenue may continue to fluctuate from quarter to quarter. As our European and APAC businesses become larger percentage of our revenues, we anticipate reduced revenue in our fourth quarter due to the seasonal slowdown caused by summer vacations and European holiday schedules.

Key business metrics

We regularly review the following key business metrics to evaluate our business, measure our performance, identify trends affecting our business, formulate financial projections and make strategic decisions. We believe that the following metrics are representative of our current business. However, we anticipate these will change or may be substituted for additional or different metrics as our business grows.

Value of orders received

We believe that the value of orders we receive is a leading indicator of our ability to generate revenue in subsequent quarters, although there can be no assurance orders will translate into revenue. We define an order as a contract with a customer or purchase order from a customer, which outlines the promised goods at an agreed upon-price. In some cases, we receive a blanket purchase order from our customers, which includes pricing, payment and other terms and conditions, with quantities defined at the time each customer subsequently issues periodic releases against the blanket purchase order. We regularly assess trends relating to the value of orders we receive, including with respect to our customer concentration.

Orders may never convert into actual revenue and the timing of delivery of our orders and recognition of revenue, if any, may vary based on the nature of the order, and there can be no assurance that orders will result in recognized revenue. The following table lists the value of orders received during the periods indicated:

	Year ended September 30,		
	2023	2022	2021
Order value	$ 263,887	$ 226,435	$ 159,545

Number of customers

We believe that the number of customers who have purchased from us since inception is representative of our ability to drive adoption of our products. We define customers as separate legal entities or persons who have purchased and directly paid for our products. This means that if a parent company is a customer of ours, it is counted as one customer, and if its subsidiary also purchases our products from us, and the subsidiary makes a payment directly to us, we count the subsidiary as a separate customer. We apply this methodology of counting customers because it is not possible for our e-commerce platform and other data tracking software to distinguish accurately between affiliated purchasers.

Percentage of revenue from new and repeat customers

We believe that the percentage of revenue that we generate from both new and repeat customers is an indicator of our ability to drive adoption of our products amongst existing customers while also generating a robust pipeline of new customers. We define a new customer as a customer who, as a separate legal entity or person, has not had multiple purchases in the current fiscal year. We define a repeat customer as any customer who, as a separate legal entity or person, has purchased products or services from us more than once in the current fiscal year.

	Year ended September 30,		
	2023	2022	2021
Number of customers	3,450	3,300	2,900
Revenue from repeat customers	98 %	98 %	98 %

Financial overview

The following table summarizes certain selected historical financial results:

	Year ended September 30,		
(in thousands)	2023	2022	2021
Revenues	$ 245,109	$ 203,565	$ 132,333
Loss from operations	(217,159)	(234,776)	(152,726)
Net loss attributable to common stockholders	(204,618)	(217,863)	(152,098)

Revenues

We generate revenue from sales of synthetic genes, oligo pools, NGS tools, DNA libraries and antibody discovery services. Our ability to increase our revenues will depend on our ability to further penetrate the domestic and international markets, generate sales through our direct sales force, distributors and over time from our e-commerce digital platform and launch new products.

Revenues by geography

We have one reportable segment from the sale of synthetic DNA products. The following table shows our revenues by geography, based on our customers' shipping addresses. Americas consists of United States, Canada, Mexico and South America; EMEA consists of Europe, Middle East and Africa; and APAC consists of Japan, China, South Korea, India, Singapore, Malaysia and Australia.

	Year ended September 30,					
(in thousands, except percentages)	2023	%	2022	%	2021	%
Americas	$ 151,263	62%	$ 122,473	61%	$ 77,909	59%
EMEA	71,389	29%	62,078	30%	44,124	33%
APAC	22,457	9%	19,014	9%	10,300	8%
Total revenues	$ 245,109	100%	$ 203,565	101%	$ 132,333	100%

Revenues by products

The table below sets forth revenues by products:

	Year ended September 30,					
(in thousands, except percentages)	2023	%	2022	%	2021	%
Synthetic genes	$ 73,541	30%	$ 61,509	30%	$ 38,964	30%
Oligo pools	14,489	6%	12,424	6%	8,039	6%
DNA libraries	10,201	4%	6,149	3%	5,678	4%
Antibody discovery	23,172	9%	24,171	12%	6,985	5%
NGS tools	123,706	51%	99,312	49%	72,667	55%
Total revenues	$ 245,109	100%	$ 203,565	100%	$ 132,333	100%

Revenues by industry

Revenues by industry were as follows:

	Year ended September 30,					
(in thousands, except percentages)	**2023**	**%**	**2022**	**%**	**2021**	**%**
Industrial chemicals/materials	$ 59,321	24%	$ 57,940	29%	$ 34,475	26%
Academic research	45,847	19%	37,097	18%	25,299	19%
Healthcare	137,148	56%	106,363	52%	71,241	54%
Food/agriculture	2,793	1%	2,165	1%	1,318	1%
Total revenues	$ 245,109	100%	$ 203,565	100%	$ 132,333	100%

Revenues and accounts receivable concentration

There are no major customers who accounted for 10% or more of our revenues for the fiscal year ended September 30, 2023, 2022, and 2021.

There is one customer who accounted for 10% or more of the net accounts receivable as of September 30, 2023. There were no major customers who accounted for 10% or more of the net accounts receivable as of September 30, 2022.

Product shipments including synthetic genes

Shipments of number of genes in years ended September 30, 2023, 2022 and 2021 were as follows:

	Year ended September 30,		
(in thousands)	**2023**	**2022**	**2021**
Number of genes shipped	634	558	372

Cost of revenues

Cost of revenues reflects the aggregate cost incurred in the production and delivery of our products and consists of production materials, personnel costs, cost of expensed equipment and consumables, laboratory supplies, consulting costs, depreciation, production overhead costs, information technology ("IT"), maintenance and facility costs. Personnel costs consist of salaries, employee benefit costs, bonuses, and stock-based compensation expenses. We expect that our cost of revenues will vary with changes in our revenues and our revenue mix.

Research and development

Research and development expenses consist primarily of costs incurred for the development of our products, which include personnel costs, laboratory equipment and supplies, consulting costs, depreciation, rent, IT, maintenance and facility costs. Personnel costs consist of salaries, employee benefit costs, bonuses, and stock-based compensation expenses. We expense our research and development expenses in the period in which they are incurred.

Selling, general and administrative

Selling expenses consist of personnel costs, customer service expenses, direct marketing expenses, educational and promotional expense, market research and analysis. General and administrative expenses are incurred for executive, finance and accounting, legal and human resources functions and consist of personnel costs, audit and legal expenses, consulting costs, depreciation, insurance costs, travel expenses, rent, IT, maintenance and facility costs. Personnel costs consist of salaries, employee benefit costs, bonuses, commissions and stock-based compensation expenses. We expense all selling, general and administrative expenses as incurred. We expect our selling costs will continue to increase in absolute dollars, primarily driven by our efforts to expand our commercial capability, with an increased presence both within and outside the United States, and to expand our brand awareness and customer base through targeted marketing initiatives.

Change in fair value of contingent considerations and holdbacks

Change in fair value of contingent considerations and holdbacks consists of remeasurement of contingent consideration and indemnity holdbacks related to the acquisitions of Abveris and iGenomX.

Interest expense

Interest expense is attributable to borrowing under our senior secured term loan which was paid in December 2021.

Interest income

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

Gain on deconsolidation of a subsidiary

Gain on deconsolidation of a subsidiary represents gain on deconsolidation of Revelar Biotherapeutics, Inc. ("Revelar").

Restructuring and other costs

Restructuring and other costs consist of costs associated with employee severance and related benefits, asset impairments and other associated costs resulting from the 2023 restructuring plan as well as other asset impairments incurred during the year.

Other income (expense), net

Other income (expense), net consists of realized foreign exchange gains and losses and loss on disposal of property and equipment.

Results of operations

The following table sets forth selected consolidated statements of operations data for the fiscal years indicated and the percentage change in such data from year to year. These historical operating results may not be indicative of the results for any future period.

	Year ended September 30,		
(in thousands)	2023	2022	2021
Revenues	$ 245,109	$ 203,565	$ 132,333
Operating expenses:			
Cost of revenues	$ 155,380	$ 119,330	$ 80,620
Research and development	106,894	120,307	69,072
Selling, general and administrative	189,738	212,949	135,901
Restructuring and other costs	16,169	—	—
Change in fair value of contingent considerations and holdbacks	(5,913)	(14,245)	(534)
Total operating expenses	$ 462,268	$ 438,341	$ 285,059
Loss from operations	$ (217,159)	$ (234,776)	$ (152,726)
Interest income	14,365	3,062	435
Interest expense	(5)	(80)	(367)
Gain on deconsolidation of a subsidiary	—	4,607	—
Other income (expense), net	(667)	(1,087)	(1,370)
(Provision for) benefit from income taxes	(1,152)	10,411	1,930
Net loss attributable to common stockholders	$ (204,618)	$ (217,863)	$ (152,098)

Comparison of the years ended September 30, 2023, 2022 and 2021

Revenues

	Year ended September 30,			Change			
(in thousands, except percentages)	2023	2022	2021	2023-2022		2022-2021	
Revenues	$ 245,109	$ 203,565	$ 132,333	$ 41,544	20%	$ 71,232	54%

Revenues increased from $203.6 million to $245.1 million in the year ended September 30, 2023, which was an increase of $41.5 million, or 20%, as compared to the same period in 2022. The increase in revenue was primarily due to increase in revenue from NGS tools, which grew from $99.3 million in 2022 to $123.7 million in 2023, an increase in revenue from synthetic genes, which grew from $61.5 million in 2022 to $73.5 million and an increase in revenue from DNA libraries revenue, which grew from $6.1 million in 2022 to $10.2 million. The growth in NGS tools revenue is primarily attributable to an increase in revenue from our top customers and the adoption of our product by a larger customers base. Our synthetic genes revenue grew mainly from our top customers and growth in the healthcare and academic research industries as well as an improved turnaround time. In the year ended September 30, 2023, we shipped approximately 634,000 genes compared to approximately 558,000 genes in the year ended September 30, 2022, an increase of 14%. Changes in our synthetic gene pricing, while favorable, had a minimal impact on our results of operations period-over-period. Our DNA libraries revenue grew year over year as a result of increased customers, mainly in the healthcare and academic research industries.

Revenues increased from $132.3 million to $203.6 million in the year ended September 30, 2022, which was an increase of $71.2 million, or 54%, as compared to the same period in 2021. The increase in revenue was primarily due to increase in revenue from NGS tools, which grew from $72.7 million in 2021 to $99.3 million in 2022, an increase in revenue from synthetic genes which grew from $39.0 million in 2021 to $61.5 million and an increase in revenue from antibody discovery, which grew from $7.0 million in 2021 to $24.2 million. The primary reason for NGS tools revenue growth was an increase in both revenue from our top customers and adoption of our product by a larger customer base. We do not believe that pricing changes had a meaningful impact on revenue from NGS tools period-over-period. Our synthetic genes revenue grew mainly due to growth in our customers across all industries including industrial chemicals, healthcare and academic research. In the year ended September 30, 2022, we shipped approximately 558,000 genes compared to approximately 372,000 genes in the year ended September 30, 2021, an increase of 50%. Synthetic gene pricing to our customers was relatively constant period-over-period. Our antibody services revenue grew year over year as a result of Abveris acquisition and an increase in the Twist Antibody discovery project revenue.

A discussion of our revenues for the year ended September 30, 2021 can be found on page 53 of our Annual Report on Form 10-K for the fiscal year ended September 30, 2022 filed with the SEC on November 28, 2022, or our 2022 Annual Report.

Cost of revenues

	Year ended September 30,			Change			
(in thousands, except percentages)	2023	2022	2021	2023-2022		2022-2021	
Cost of revenues	$ 155,380	$ 119,330	$ 80,620	$ 36,050	30%	$ 38,710	48%

Cost of revenues increased from $119.3 million in the prior year to $155.4 million in the year ended September 30, 2023, an increase of $36.1 million, or 30%. The $14.7 million increase in material costs is due to higher volume. The increase in payroll and depreciation expenses was primarily due to the build out of the Factory of the Future, which is a second manufacturing facility located in Wilsonville, Oregon. Payroll, including stock-based compensation, increased $9.9 million, which included $7.4 million of savings related to the 2023 restructuring plan. Depreciation and amortization increased by $11.9 million associated with the capital investment to increase capacity.

Cost of revenues increased from $80.6 million in the prior year to $119.3 million in the year ended September 30, 2022, which was an increase of $38.7 million, or 48%. The increase was primarily due to an increase in the cost of consumption of reagents and production materials costs of $20.4 million associated with increased production due to higher sales volume and product shipments. The increase in personnel costs of $7.7 million was mainly due to increased headcount to support growth in the volumes. Maintenance costs increased by $2.6 million, equipment costs increased by $1.3 million and depreciation expense increased by $3.3 million due to investment in equipment. Our cost of revenues represented 59% and 61% of total revenues for the year ended September 30, 2022 and 2021, respectively. The favorable change in cost of revenues as a percentage of total revenues was mainly due to an increase in volume of product sold and change in the mix of products sold during the current year.

A discussion of our cost of revenues for the year ended September 30, 2021 can be found on page 54 of our 2022 Annual Report.

Research and development expenses

(in thousands, except percentages)	Year ended September 30, 2023	2022	2021	Change 2023-2022		2022-2021	
Research and development	$ 106,894	$ 120,307	$ 69,072	$ (13,413)	(11)%	$ 51,235	74%

Research and development expenses decreased by $13.4 million to $106.9 million for the year ended September 30, 2023, as compared to the same period 2022. The decrease is primarily due to the deconsolidation of Revelar in fiscal year 2022, which contributed to a decrease of $14.1 million. Excluding the impact of Revelar, research and development expenses increased $0.7 million. The increase is primarily due to increases in lab supplies of $1.5 million, outside services of $0.7 million, and depreciation of $0.6 million. Additionally, grant reimbursements, which are netted against our research and development expenses, were $1.6 million lower during the year ended September 30, 2023 than the prior year. The increase was partially offset by a $4.0 million decrease in payroll, which consists of a $1.6 million increase in payroll, offset by a decrease of $5.6 million in stock-based compensation.

Research and development costs increased by $51.2 million to $120.3 million for the year ended September 30, 2022, as compared to the same period 2021. The increase was mainly in personnel costs of $31.3 million associated with an increase in our research and development headcount, an increase in laboratory supplies costs of $13.8 million due to an increase in research activities, including $8.0 million for Revelar, an increase in the rent expense of $2.6 million associated with increased research and development laboratory space and an increase in outside services of $3.5 million primarily associated with development activities for our data storage technology.

A discussion of our research and development expenses for the year ended September 30, 2021 can be found on page 54 of our 2022 Annual Report.

Selling, general and administrative expenses

(in thousands, except percentages)	Year ended September 30, 2023	2022	2021	Change 2023-2022		2022-2021	
Selling, general and administrative	$ 189,738	$ 212,949	$ 135,901	$ (23,211)	(11)%	$ 77,048	57%

Total selling, general and administrative expenses decreased by $23.2 million to $189.7 million for the year ended September 30, 2023, compared to the same period for 2022. The decrease is primarily attributable to a decrease in stock-based compensation of $43.0 million due to employee stock forfeitures related to an acquisition performance condition not being met and changes to the probability of achieving future performance conditions. The decrease was partially offset by increases in pre-commercialization Factory of the Future costs of $4.4 million, facility costs of $6.5 million, payroll costs of $5.3 million and IT-related services costs of $5.1 million.

For the year ended September 30, 2022, selling, general and administrative expenses increased by $77.0 million to $212.9 million, compared to the same period for 2021. The increase in expenses was primarily due to an increase in personnel costs by $50.9 million, as a result of an increase in headcount in the commercial organization and included $30.8 million higher stock-based compensation expense. Advertising costs increased by $1.7 million, consulting costs increased by $3.4 million, depreciation expense increased by $3.5 million, facility costs increased by $2.3 million, legal costs increased by $1.4 million, online services costs increased by $1.3 million, travel costs increased by $3.7 million, rent expense increased by $2.2 million and other costs including audit expenses, equipment costs and laboratory supplies increased by $6.6 million.

For the year ended September 30, 2022, selling, general and administrative expenses included costs associated our Wilsonville, Oregon manufacturing facility. These costs included personnel costs of $6.0 million, facility costs of $4.6 million, outside services of $2.2 million, laboratory supplies of $1.3 million and other costs of $1.8 million.

A discussion of our selling, general and administrative expenses for the year ended September 30, 2021 can be found on page 55 of our 2022 Annual Report.

Restructuring and other costs

(in thousands, except percentages)	Year ended September 30, 2023	2022	2021	Change 2023-2022		2022-2021	
Restructuring and other costs	$ 16,169	$ —	$ —	$ 16,169	100%	$ —	—%

During the year ended September 30, 2023, we recognized restructuring and other costs of $16.2 million. Refer to Note 14 to the consolidated financial statements for further details.

Change in fair value of contingent considerations and holdbacks

(in thousands, except percentages)	Year ended September 30, 2023	2022	2021	Change 2023-2022		2022-2021	
Change in fair value of contingent considerations and holdbacks	$ (5,913)	$ (14,245)	$ (534)	$ 8,332	(58)%	$ (13,711)	2568 %

During the year ended September 30, 2023, we recognized a change in the fair value of contingent consideration and holdbacks of $5.5 million and $0.4 million related to the acquisitions of Abveris and iGenomX, respectively. The changes are the result of not achieving the Abveris revenue target for calendar year 2022 and a change in fair value of our stock price.

During the year ended September 30, 2022, we recognized the change in the fair value of the contingent consideration and holdbacks of $13.4 million and $0.8 million related to the acquisitions of Abveris and iGenomX, respectively. The change is primarily the result of the change in fair value of our stock price as of September 30, 2022 and a change in the probability of the attainment of the calendar year 2022 revenue target.

Interest, and other income (expense), net

(in thousands, except percentages)	Year ended September 30, 2023	2022	2021	Change 2023-2022		2022-2021	
Interest income	$ 14,365	$ 3,062	$ 435	$ 11,303	369 %	$ 2,627	604 %
Interest expense	(5)	(80)	(367)	75	(94)%	287	(78)%
Other income (expense)	(667)	(1,087)	(1,370)	420	(39)%	283	(21)%
Total interest, and other income (expense), net	$ 13,693	$ 1,895	$ (1,302)	$ 11,798	237 %	$ 3,197	505 %

Interest income was $14.4 million in the year ended September 30, 2023, $3.1 million for the year ended September 30, 2022 and $0.4 million for the year ended September 30, 2021, resulting from our short-term investments. Interest expense was $0.1 million in fiscal year 2022 and $0.4 million in fiscal year 2021 mainly due to the reduction in the amount of debt outstanding under a credit facility. Other expense was $0.7 million in fiscal year 2023, $1.1 million in fiscal year 2022 and $1.4 million in fiscal year 2021, mainly due to one-time costs not related to our normal business activities.

Gain on deconsolidation of a subsidiary

(in thousands, except percentages)	Year ended September 30, 2023	2022	2021	Change 2023-2022		2022-2021	
Gain on deconsolidation of a subsidiary	—	4,607	—	$ (4,607)	(100)%	$ 4,607	100 %

Gain on deconsolidation of a subsidiary represents the gain associated with the deconsolidation of a variable interest entity, Revelar, on September 30, 2022.

(Provision for) benefit from income taxes

	Year ended September 30,			Change			
(in thousands, except percentages)	**2023**	**2022**	**2021**	**2023-2022**		**2022-2021**	
(Provision for) benefit from income taxes	$ (1,152)	$ 10,411	$ 1,930	$ (11,563)	(111)%	$ 8,481	439%

We recorded income tax provision of $1.2 million in 2023. We recorded income tax benefit of $10.4 million and $1.9 million in 2022 and 2021 respectively, mainly as a result of the business acquisition of Abveris and iGenomX respectively.

Liquidity and capital resources

Sources of liquidity

To date, we have financed our operations principally through public equity raises, private placements of our convertible preferred stock, borrowings from credit facilities and revenue from our commercial operations.

Since our inception on February 4, 2013 and through September 30, 2023, we have received an aggregate of $1,333.7 million in net proceeds from the issuance of equity securities and an aggregate of $13.8 million from debt. As of September 30, 2023, we had a balance of $286.5 million of cash and cash equivalents and $49.9 million in short-term investments.

Capital resources

Our primary cash needs are for operating expenses, working capital and capital expenditures to support the growth in our business. As of September 30, 2023, we had cash, cash equivalents and short-term investments of $336.4 million.

We believe that our existing cash, cash equivalents and short-term investments are sufficient to fund our operating expenses, capital expenditure requirements and debt service payments for the next 12 months. In the future, we may still need to obtain additional financing to fund operations beyond this period, and there can be no assurance that we will be successful in raising additional financing on terms which are acceptable to us. In addition, our operating plans may change as a result of factors currently unknown to us, and we may need to seek additional funds sooner than planned. Such financing may result in dilution to stockholders, imposition of debt covenants and repayment obligations, or other restrictions that may adversely affect our business. In addition, we may seek additional capital due to favorable market conditions or strategic considerations even if we believe we have sufficient funds for our current or future operating plans. Our future capital requirements will depend on many factors. See “Risk factors—We will require additional financing to achieve our goals, and a failure to obtain this necessary capital when needed on acceptable terms, or at all, could force us to delay, limit, reduce or terminate our product manufacturing and development and other operations.”

Inflation Risk

While we have experienced increased operating costs in recent periods, which we believe are due in part to the recent growth in inflation, we do not believe that inflation has had a material effect on our business, financial condition or results of operations. If our costs were to become subject to significant inflationary pressures, we may not be able to fully offset such higher costs through price increases. Our inability or failure to do so could adversely affect our business, financial condition and results of operations.

Operating capital requirements

Our primary uses of capital are, and we expect will continue to be for the near future, compensation and related expenses, manufacturing costs, laboratory and related supplies, legal and other regulatory expenses, and general overhead costs and the capital expenditures for the Wilsonville, Oregon facility expansion. We had $1.6 million and $10.1 million in commitments for capital expenditures as of September 30, 2023 and 2022, respectively.

Cash flows

The following table summarizes our sources and uses of cash and cash equivalents:

	Year ended September 30,		
(in thousands)	2023	2022	2021
Net cash used in operating activities	$ (142,474)	$ (124,385)	$ (112,244)
Net cash provided by (used in) investing activities	50,612	(232,930)	156,155
Net cash provided by financing activities	911	270,534	329,182

Operating activities

Net cash used in operating activities was $142.5 million in fiscal year 2023 and consisted primarily of a net loss of $204.6 million adjusted for non-cash items including depreciation and amortization expenses of $29.3 million, stock-based compensation expense of $30.3 million, impairment of property and equipment and other assets of $6.8 million, non-cash lease expense of $2.6 million, change in fair value of contingent consideration and holdbacks of $5.9 million and a change

in operating assets and liabilities of $1.0 million. The change in operating assets and liabilities was mainly due to increases in accounts receivable of $4.3 million, prepaid and other current assets of $4.2 million and accrued expenses of $2.6 million, offset by decreases in inventory of $7.2 million, other non-current assets of $1.4 million, accounts payable of $2.5 million, accrued compensation of $1.1 million and other liabilities $0.1 million.

Net cash used in operating activities was $124.4 million in fiscal year 2022 and consisted primarily of a net loss of $217.9 million adjusted for non-cash items including depreciation and amortization expenses of $16.5 million, stock-based compensation expense of $79.7 million, a tenant improvement allowance net of operating lease expense of $20.1 million, gain on deconsolidation of subsidiary of $4.6 million, change in fair value of contingent consideration and holdbacks of $14.2 million, a change in operating assets and liabilities of $5.4 million, and a net total of other non-cash items of $1.4 million. The change in operating assets and liabilities was mainly due to increases in account receivable of $9.6 million, inventory of $7.5 million, prepaid expenses and other current assets of $2.6 million, accounts payable of $7.4 million, accrued expenses of $2.3 million, accrued compensation of $4.9 million, offset by decreases in other non-current assets of $7.3 million, and other liabilities of $7.4 million.

A discussion of net cash used in operating activities for the fiscal year 2021 can be found on page 58 of our 2022 Annual Report.

Investing activities

In fiscal year 2023, our net cash used in the investing activities was $50.6 million primarily as a result of the net result of purchases and maturity of investments of $78.4 million and purchases of laboratory property, equipment and computers of $27.8 million.

In fiscal year 2022, our net cash used in the investing activities was $232.9 million primarily as a result of net impact of purchases and maturity of investments of $117.2 million, purchases of laboratory property, equipment and computers of $101.9 million, new business acquired of $8.2 million and deconsolidation of Revelar of $5.8 million.

A discussion of net cash used in investing activities for the fiscal year 2021 can be found on page 58 of our 2022 Annual Report.

Financing activities

Net cash provided by financing activities was $0.9 million in fiscal year 2023, which consisted of $3.9 million from proceeds from issuance of shares under the 2018 ESPP and $1.4 million from the exercise of stock options, offset by $4.4 million in repurchases of common stock for income tax withholdings.

Net cash provided by financing activities was $270.5 million in fiscal year 2022, which consisted of $269.8 million in proceeds from a public offering of our common stock, net of underwriting discounts and commissions and offering expenses, $4.0 million from proceeds from issuance of shares under the 2018 ESPP and $6.0 million from the exercise of stock options, offset by $1.6 million in principal payments on long term debt and $7.8 million in repurchases of common stock for income tax withholdings.

A discussion of net cash provided by financing activities for the fiscal year 2021 can be found on page 58 of our 2022 Annual Report.

Off-balance sheet arrangements

We do not have any off-balance sheet arrangements other than our indemnification agreements as described in Note 6 of the consolidated financial statements included elsewhere in this Form 10-K.

Contractual obligations and other commitments

On May 30, 2023, Abveris, our subsidiary, entered into an amendment to its existing lease agreement for approximately 17,200 square-feet primarily consisting of two additional spaces located in Quincy, Massachusetts, to further expand operations. The term of the lease for both spaces ends on August 31, 2032. We have two options to extend the term for five years. We do not have reasonable certainty that these options will be exercised. Upon execution of the lease agreement, Abveris provided the landlord an additional approximate $0.5 million irrevocable letter of credit as a security deposit. The annual base rent for premises A will increase by 2.0% each year for the first two years and then 2.75% for each year thereafter plus certain operating expenses. The annual base rent for premises B will increase by 2.75% each year, plus certain operating expenses. We have the right to sublease the facility, subject to landlord consent. The premises A and B lease commenced in June 2023 and August 2023, respectively. As of the lease commencement dates, the total future minimum lease payments under the agreement were $8.6 million.

Critical accounting policies and estimates

The discussion and analysis of our financial condition and results of operations are based upon our audited consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States. The preparation of these financial statements requires management to make estimates and judgments that affect the reported amounts of assets, liabilities, revenues and expenses, and related disclosures of contingent assets and liabilities. On an ongoing basis, management evaluates the reasonableness of its estimates. Management bases its estimates on historical experience and on various assumptions that are believed to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily available from other sources. Actual results may differ materially from these estimates under different assumptions or conditions.

We believe the following critical accounting policies require that we make significant judgments and estimates in preparing our consolidated financial statements.

Revenue recognition

Our revenue is generated through the sale of synthetic biology tools, such as synthetic genes, or clonal genes and fragments, oligonucleotide pools, or oligo pools, NGS tools and DNA libraries. We recognize revenue when control of the products is transferred to the customer and at a transaction price that is determined based on the agreed upon rates in the applicable order or master supply agreement applied to the quantity of synthetic DNA that was manufactured and shipped to the customer.

Contracts with customers are in the written form of a purchase order or a quotation, which outline the promised goods and the agreed upon price. Such orders may be accompanied by a Master Supply or Distribution Agreement that establishes the terms and conditions, rights of the parties, delivery terms, and pricing. We assess collectability based on a number of factors, including past transaction history and creditworthiness of the customer.

The transaction price is determined based on the agreed upon rates in the purchase order or master supply agreements applied to the quantity of all the products that were manufactured and shipped to the customer. Our contracts may include one or more ordered products, and the shipment of these products comprises the performance obligation(s) under the contract. Accordingly, all of the transaction price, net of any discounts, is allocated to the one performance obligation. Our sales are primarily subject to Ex Works (as defined in Incoterms 2010) delivery terms and revenue, other than Biopharma revenue, is recorded at the point in time when products are picked up by the customer's freight forwarder, as we have determined that this is the point in time that product control transfers to the customer. Therefore, upon shipment of the product, there are no remaining performance obligations. Our shipping and handling activities are performed before the customer obtains control of the goods and therefore are considered a fulfillment cost. Shipping and handling fees charged to our customers are recognized as product revenue in the period shipped and the related costs for providing these services are recorded as a cost of revenue. We have elected to exclude all sales and value added taxes from the measurement of the transaction price. We have not adjusted the transaction price for significant financing since the time period between the transfer of goods and payment is less than one year. We have elected the practical expedient of not disclosing the consideration allocated to remaining performance obligations and an explanation of when those amounts are expected to be recognized as revenue since the duration of our contracts is less than one year.

Our Biopharma revenue currently primarily consists of research and development agreements with third parties that provide for up-front and milestone-based payments. We also enter into research and development agreements that do not include up-front or milestone-based payments and recognize revenue on these types of agreements based on the timing of development activities. Our research and development agreements may include more than one performance obligation. At the inception of the agreement, we assess whether each obligation represents a separate performance obligation or whether such obligations should be combined as a single performance obligation. The transaction price for each agreement is determined based on the amount of consideration we expect to be entitled to for satisfying all performance obligations within the agreement. We assess the nature of the combined performance obligation to determine whether the combined performance obligation is satisfied over time or at a point in time and, if over time, the appropriate method of measuring progress for purposes of recognizing revenue. In agreements where we satisfy performance obligation(s) over time, we recognize development revenue typically using an input method based on our costs incurred relative to the total expected cost which determines the extent of our progress toward completion. As part of the accounting for these arrangements, we must develop estimates and assumptions that require judgment to determine the transaction price and progress towards completion. We review our estimate of the transaction price and progress toward completion based on the best information available to recognize the cumulative progress toward completion as of the end of each reporting period and make revisions to such estimates as necessary. Also, these research and development agreements may include license payments. We recognize revenue from functional license agreements when the license is transferred to the customer and the customer is able to use and benefit from the license. A functional license has significant standalone functionality because it can be used "as is" for performing a specific task.

We had contract assets of $2.8 million and contract liabilities of $3.0 million as of September 30, 2023. We had contract assets of $3.4 million and contract liabilities of $3.5 million as of September 30, 2022. For the years ended September 30, 2023 and 2022, we recognized revenue of $2.8 million and $1.1 million, respectively, from the amount that was included in the contract liability balance at the beginning of each year. For the year ended September 30, 2021, the Company did not recognize revenue from amounts that was included in the contract liability balance at the beginning of the period. In addition, for all periods presented, there was no revenue recognized in a reporting period from performance obligations satisfied in previous periods. The aggregate amount of the transaction price allocated to the performance obligations that are unsatisfied as of September 30, 2023 was $5.3 million. We expect to recognize revenue over the next twelve months relating to performance obligations unsatisfied as of September 30, 2023.

Based on the nature of our contracts with customers which are recognized over a term of less than 12 months, we have elected to use the practical expedient whereby costs to obtain a contract are expensed as they are incurred.

We state our revenues net of any taxes collected from customers that are required to be remitted to various government agencies. The amount of taxes collected from customers and payable to governmental entities is included on the balance sheet as part of "Accrued expenses and other current liabilities."

Stock-based compensation

We have granted stock-based awards, consisting of stock options and restricted stock, to our employees, certain non-employee consultants and certain members of our board of directors. We measure stock-based compensation expense for restricted stock and stock options granted to our employees and directors on the date of grant and recognize the corresponding compensation expense of those awards over the requisite service period, which is generally the vesting period of the respective award. We measure stock-based compensation expense for restricted stock and stock options granted to non-employee consultants on the date of grant and recognize the corresponding compensation expense of those awards over the period in which the related services are received. We adjust for actual forfeitures as they occur.

We have granted performance-based stock units (PSUs) and performance stock options (PSOs) to executive officers and senior level employees. We value PSUs using a grant date fair value equal to the closing share price of our common stock on the date of grant and the probability of the achievement of the performance condition.

We estimate the fair value of stock options granted to our employees, directors and non-employee consultants on the grant date, and rights to acquire stock granted under our Employee Stock Purchase Plan, and the resulting stock-based compensation expense, using the Black-Scholes option-pricing model. The Black-Scholes option-pricing model requires the use of highly subjective assumptions which determine the fair value of stock-based awards. These assumptions include:

- *Expected Term*. Our expected term represents the period that our stock-based awards are expected to be outstanding and is determined using the simplified method (based on the mid-point between the vesting date and the end of the contractual term), as we do not have sufficient historical data to use any other method to estimate expected term.

- *Expected Volatility*. As we have very limited trading history of our common stock, the expected volatility is estimated based on the average volatility for comparable publicly traded biopharmaceutical companies over a period equal to the expected term of the stock option grants. The comparable companies are chosen based on their similar size, stage in the life cycle or area of specialty.

- *Risk-Free Interest Rate*. The risk-free interest rate is based on the U.S. Treasury zero coupon issues in effect at the time of grant for periods corresponding with the expected term of the stock option grants.

- *Expected Dividend*. We have never paid dividends on our common stock and have no plans to pay dividends on our common stock. Therefore, we use an expected dividend yield of zero.

Business Combinations

Accounting for business combinations requires management to make significant estimates and assumptions as of the acquisition date which are inherently uncertain. Intangible assets we have recognized from such transactions include goodwill, developed technology and customer relationships. Significant judgment was exercised in estimating the fair value of the developed technology and customer relationships, which included estimates and assumptions related to the projected revenues (specifically forecasted selling prices and unit volume of sales), and discount rates. Similarly, significant judgment was exercised in estimating the contingent consideration which included key assumptions related to the forecasted revenue and the Company's share price and progress toward completion of transition milestones.

The rates used to discount expected future cash flows to present value are typically derived from a weighted-average cost of capital analysis and adjusted to reflect inherent risks. Unanticipated events and circumstances may occur that could affect either the accuracy or validity of such assumptions, estimates or actual results.

Goodwill

Determining when to test for impairment, the reporting unit, the assets and liabilities of the reporting unit, and the fair value of the reporting unit requires significant judgment and involves the use of significant estimates and assumptions. We test goodwill for impairment in our fourth quarter each year, or more frequently if indicators of an impairment exist. Evaluating goodwill for impairment involves the determination of the fair value of our reporting unit in which goodwill and indefinite-lived intangible assets is recorded using a qualitative or quantitative analysis. If the fair value of the reporting unit exceeds its carrying value, goodwill is considered not impaired. If the carrying value of the reporting unit exceeds its fair value, we would record an impairment loss up to the difference between the carrying value and implied fair value.

We have an unconditional option to bypass the qualitative assessment in any period and proceed directly to performing the first step of the goodwill impairment test. For 2023, we elected to proceed directly to the step-one assessment which indicated that the fair value of our reporting unit substantially exceeded the carrying value.

Restructuring costs

We recognize restructuring charges related to restructuring plans that have been committed to by management when liabilities have been incurred. In connection with these activities, we record restructuring charges at fair value for (a) contractual employee termination benefits when obligations are associated to services already rendered, rights to such benefits have vested, and payment of benefits is probable and can be reasonably estimated, (b) one-time employee termination benefits when management has committed to a plan of termination, the plan identifies the employees and their expected termination dates, the details of termination benefits are complete, it is unlikely changes to the plan will be made or the plan will be withdrawn and communication to such employees has occurred, and (c) contract termination costs when a contract is terminated before the end of its term.

One-time employee termination benefits are recognized in their entirety when communication has occurred and future services are not required. If future services are required, the costs are recorded ratably over the remaining period of service. Contract termination costs to be incurred over the remaining contract term without economic benefit are recorded in their entirety when the contract is canceled.

Recently issued accounting pronouncements

For a description of accounting changes and recent accounting pronouncements, including the expected dates of adoption and estimated effects, if any, on our consolidated financial statements, see Note 2, “Summary of Significant Accounting Policies” in the Notes to Consolidated Financial Statements in Item 8 of this Annual Report on Form 10-K.

Item 7A. *Quantitative and qualitative disclosures about market risk*

Interest rate sensitivity

We are exposed to market risk related to changes in interest rates. We had cash, cash equivalents and marketable securities of $336.4 million as of September 30, 2023, which consisted primarily of money market funds and marketable securities, largely composed of investment grade, short term fixed income securities.

The primary objective of our investment activities is to preserve capital to fund our operations. We also seek to maximize income from our investments without assuming significant risk. To achieve our objectives, we maintain a portfolio of investments in a variety of securities of high credit quality and short-term duration, according to our board-approved investment policy. Our investments are subject to interest rate risk and could fall in value if market interest rates increase. However, because of the short-term nature of the instruments in our portfolio, a sudden change in market interest rates would not be expected to have a material impact on our financial condition or results of operations. For example, a hypothetical 10% relative change in interest rates during any of the periods presented would not have a material impact on our consolidated financial statements.

Foreign currency sensitivity

The majority of our transactions occur in U.S. dollars. However, we do have certain transactions that are denominated in currencies other than the U.S. dollar, primarily the Euro, Chinese Yuan, and British Pound, and we therefore are subject to foreign exchange risk. The fluctuation in the value of the U.S. dollar against other currencies affects the reported amounts of expenses, assets and liabilities primarily associated with a limited number of manufacturing activities.

We do not use derivative financial instruments for speculative trading purposes, nor do we hedge foreign currency exchange rate exposure in a manner that entirely offsets the effects of changes in foreign currency exchange rates. The counterparties to these forward foreign currency exchange contracts are creditworthy multinational commercial banks, which minimizes the risk of counterparty nonperformance. We regularly review our exposure and may, as part of this review, make changes to it.

Item 8. ***Consolidated financial statements and supplementary data***

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

Report of Independent Registered Public Accounting Firm

To the Stockholders and the Board of Directors of Twist Bioscience Corporation

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Twist Bioscience Corporation (the Company) as of September 30, 2023 and 2022, the related consolidated statements of operations and comprehensive loss, stockholders' equity and cash flows for each of the two years in the period ended September 30, 2023, and the related notes (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at September 30, 2023 and 2022, and the results of its operations and its cash flows for each of the two years in the period ended September 30, 2023, in conformity with U.S. generally accepted accounting principles.

We also have 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 September 30, 2023, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework), and our report dated November 21, 2023 expressed an adverse opinion thereon.

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 the critical audit matter does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Revenue recognition

Description of the Matter	As described in Note 2 to the consolidated financial statements, the Company's revenue for certain products is generated through the sale of synthetic biology tools, such as synthetic genes, oligo pools, and next generation sequencing tools. Management recognizes revenue for these products when control of the product is transferred to the customer and at a transaction price that is determined based on the agreed upon rates in the applicable order. The Company's revenue for products generated from synthetic genes, oligo pools, and next generation sequencing tools was $212 million for the year ended September 30, 2023. The accuracy and occurrence of revenues is dependent on customer orders being accurately recorded, shipped, and invoiced, and involves several applications and data sources needed for the initiation, processing, and recording of transactions. Auditing the Company's accounting for this revenue from contracts with customers was challenging and complex primarily due to the high volume of transactions, as well as the multiple applications and data sources associated with the revenue recognition process and the fact that a material weakness was identified relating to IT systems for which controls within this process have been assessed as ineffective.
How We Addressed the Matter in Our Audit	To test the Company's accounting for revenue from contracts with customers for these products, we performed substantive audit procedures that included, among others, applying lowered testing thresholds and performing expanded testing of sales transactions on a sample basis as a result of the unremediated material weakness, performing data analytics to test recorded revenue amounts, tracing a sample of sales transactions to supporting documentation, testing a sample of cash collections, and testing credit memo activity.

/s/ Ernst & Young LLP

We have served as the Company's auditor since 2022.
San Mateo, California
November 21, 2023

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of Twist Bioscience Corporation

Opinion on the Financial Statements

We have audited the consolidated statements of operations and comprehensive loss, of redeemable convertible preferred stock and stockholders' equity and of cash flows of Twist Bioscience Corporation and its subsidiaries (the "Company") for the year ended September 30, 2021, including the related notes (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the results of operations and cash flows of the Company for the year ended September 30, 2021, in conformity with accounting principles generally accepted in the United States of America.

Basis for Opinion

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

We conducted our audit of these consolidated financial statements 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 consolidated financial statements are free of material misstatement, whether due to error or fraud.

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

/s/ PricewaterhouseCoopers LLP
San Jose, California
November 22, 2021

We served as the Company's auditor from 2015 to 2021.

Twist Bioscience Corporation
Consolidated Balance Sheets

(In thousands except per share data)	September 30, 2023	September 30, 2022
Assets		
Current assets:		
Cash and cash equivalents	$ 286,470	$ 378,687
Short-term investments	49,943	126,281
Accounts receivable, net	44,064	40,294
Inventories	32,063	39,307
Prepaid expenses and other current assets	11,716	11,914
Total current assets	$ 424,256	$ 596,483
Property and equipment, net	131,830	139,441
Operating lease right-of-use assets	71,531	74,948
Goodwill	85,811	85,811
Intangible assets, net	54,483	59,738
Restricted cash, non-current	2,811	1,572
Other non-current assets	5,681	3,385
Total assets	$ 776,403	$ 961,378
Liabilities and stockholders' equity		
Current liabilities:		
Accounts payable	$ 14,052	$ 20,092
Accrued expenses	10,754	10,169
Accrued compensation	25,818	27,023
Current portion of operating lease liability	14,896	13,642
Other current liabilities	7,803	19,737
Total current liabilities	$ 73,323	$ 90,663
Operating lease liability, net of current portion	79,173	81,270
Other non-current liabilities	475	60
Total liabilities	$ 152,971	$ 171,993
Commitments and contingencies (Note 6)		
Stockholders' equity		
Common stock, $0.00001 par value — 100,000 and 100,000 shares authorized at September 30, 2023 and 2022, respectively; 57,557 and 56,523 shares issued and outstanding at September 30, 2023 and 2022, respectively	$ —	$ —
Additional paid-in capital	1,657,222	1,619,644
Accumulated other comprehensive loss	(756)	(1,843)
Accumulated deficit	(1,033,034)	(828,416)
Total stockholders' equity	$ 623,432	$ 789,385
Total liabilities and stockholders' equity	$ 776,403	$ 961,378

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

Twist Bioscience Corporation
Consolidated Statements of Operations and Comprehensive Loss

(In thousands, except per share data)	Year ended September 30, 2023	2022	2021
Revenues [1]	$ 245,109	$ 203,565	$ 132,333
Operating expenses:			
Cost of revenues	$ 155,380	$ 119,330	$ 80,620
Research and development	106,894	120,307	69,072
Selling, general and administrative	189,738	212,949	135,901
Restructuring and other costs	16,169	—	—
Change in fair value of contingent considerations and holdbacks	(5,913)	(14,245)	(534)
Total operating expenses	$ 462,268	$ 438,341	$ 285,059
Loss from operations	$ (217,159)	$ (234,776)	$ (152,726)
Interest income	14,365	3,062	435
Interest expense	(5)	(80)	(367)
Gain on deconsolidation of subsidiary	—	4,607	—
Other income (expense), net	(667)	(1,087)	(1,370)
Loss before income taxes	$ (203,466)	$ (228,274)	$ (154,028)
(Provision for) benefit from income taxes	(1,152)	10,411	1,930
Net loss attributable to common stockholders	$ (204,618)	$ (217,863)	$ (152,098)
Other comprehensive loss:			
Change in unrealized gain (loss) on investments	$ 1,510	$ (1,594)	$ (14)
Foreign currency translation adjustment	(423)	(795)	473
Comprehensive loss	$ (203,531)	$ (220,252)	$ (151,639)
Net loss per share attributable to common stockholders—basic and diluted	$ (3.60)	$ (4.04)	$ (3.15)
Weighted average shares used in computing net loss per share attributable to common stockholders—basic and diluted	56,885	53,885	48,251

[1] During the years ended September 30, 2023, and 2022, the Company had revenues from the related parties in the amount of $5.9 million and $3.5 million, respectively. The revenues from the related parties were immaterial for the year ended September 30, 2021.

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

Twist Bioscience Corporation
Consolidated Statements of Stockholders' Equity

(In thousands)	Common stock Shares	Common stock Amount	Additional paid-in capital	Accumulated other comprehensive income / (loss)	Accumulated deficit	Total stockholders' equity
Balances as of September 30, 2020	45,083	$ —	$ 794,630	$ 87	$ (458,455)	$ 336,262
Issuance of common stock in public offerings, net of underwriting discounts, commissions and offering expenses of $21,139	3,136	—	323,861	—	—	323,861
Vesting of restricted stock units	237	—	—	—	—	—
Issuance of shares under the employee stock purchase plan	74	—	4,944	—	—	4,944
Exercise of stock options	804	—	14,471	—	—	14,471
Repurchase of early exercised stock options	(2)	—	—	—	—	—
Business acquisition	237	—	26,773	—	—	26,773
Stock-based compensation	—	—	36,998	—	—	36,998
Net exercise of stock warrants	22	—	—	—	—	—
Other comprehensive income	—	—	—	459	—	459
Repurchase of common stock for income tax withholdings	(92)	—	(10,849)	—	—	(10,849)
Net loss	—	—	—	—	(152,098)	(152,098)
Balances as of September 30, 2021	49,499	$ —	$ 1,190,828	$ 546	$ (610,553)	$ 580,821
Issuance of common stock in public offerings, net of underwriting discounts, commissions and offering expenses of $17,678	5,227	—	269,822	—	—	269,822
Vesting of restricted stock units	365	—	—	—	—	—
Issuance of shares under the employee stock purchase plan	97	—	4,010	—	—	4,010
Exercise of stock options	486	—	5,952	—	—	5,952
Business acquisition	988	—	77,122	—	—	77,122
Stock-based compensation	—	—	79,664	—	—	79,664
Other comprehensive loss	—	—	—	(2,389)	—	(2,389)
Repurchase of common stock for income tax withholdings	(139)	—	(7,754)	—	—	(7,754)
Net loss	—	—	—	—	(217,863)	(217,863)
Balances as of September 30, 2022	56,523	$ —	$ 1,619,644	$ (1,843)	$ (828,416)	$ 789,385
Vesting of restricted stock units	648	—	—	—	—	—
Issuance of shares under the employee stock purchase plan	217	—	3,937	—	—	3,937
Exercise of stock options	118	—	1,379	—	—	1,379
Business acquisition - settlement of indemnity holdback	277	—	5,860	—	—	5,860
Stock-based compensation	—	—	30,821	—	—	30,821
Other comprehensive income	—	—	—	1,087	—	1,087
Repurchase of common stock for income tax withholdings	(226)	—	(4,419)	—	—	(4,419)
Net loss	—	—	—	—	(204,618)	(204,618)
Balances as of September 30, 2023	57,557	$ —	$ 1,657,222	$ (756)	$ (1,033,034)	$ 623,432

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

Twist Bioscience Corporation
Consolidated Statements of Cash Flows

(in thousands)	Year ended September 30, 2023	2022	2021
Cash flows from operating activities			
Net loss	$ (204,618)	$ (217,863)	$ (152,098)
Adjustments to reconcile net loss to net cash used in operating activities			
Depreciation and amortization	29,310	16,514	9,750
Impairment of property and equipment and other assets	6,785	—	—
Non-cash lease expense, net of tenant improvement allowance	2,573	20,127	2,243
Stock-based compensation	30,278	79,664	36,998
Change in fair value of contingent considerations and holdbacks	(5,913)	(14,245)	(534)
Gain on deconsolidation of Revelar	—	(4,607)	—
Other non-cash adjustments	120	1,381	778
Changes in assets and liabilities:			
Accounts receivable, net	(4,320)	(9,622)	(2,202)
Inventories	7,238	(7,536)	(19,489)
Prepaid expenses and other current assets	(4,166)	(2,551)	(2,058)
Other non-current assets	1,376	7,273	(4,653)
Accounts payable	(2,508)	7,383	8,542
Accrued expenses	2,578	2,269	3,115
Accrued compensation	(1,099)	4,852	7,392
Other liabilities	(108)	(7,424)	(28)
Net cash used in operating activities	(142,474)	(124,385)	(112,244)
Cash flows from investing activities			
Purchases of property and equipment	(27,779)	(101,857)	(27,061)
Business acquisition, net of cash acquired	—	(8,160)	(483)
Deconsolidation of cash and cash equivalent relating to Revelar	—	(5,755)	—
Purchases of investments	(76,345)	(217,639)	(58,795)
Proceeds from maturity of investments	154,736	100,481	242,494
Net cash provided by (used in) investing activities	50,612	(232,930)	156,155
Cash flows from financing activities			
Proceeds from exercise of stock options	1,379	6,014	14,559
Proceeds from public offerings, net of underwriting discounts, commissions and offering expenses	—	269,822	323,861
Proceeds from issuance under employee stock purchase plan	3,937	4,010	4,944
Repayments of long-term debt	—	(1,558)	(3,333)
Repurchases of common stock for income tax withholding	(4,405)	(7,754)	(10,849)
Net cash provided by financing activities	911	270,534	329,182
Effect of exchange rates on cash, cash equivalents and restricted cash	(27)	(319)	20
Net increase (decrease) in cash, cash equivalents and restricted cash	(90,978)	(87,100)	373,113
Cash, cash equivalents, and restricted cash at beginning of year	380,259	467,359	94,246
Cash, cash equivalents, and restricted cash at end of year	$ 289,281	$ 380,259	$ 467,359
Supplemental disclosure of cash flow information			
Interest paid	$ —	$ 9	$ 167
Income taxes paid, net of refunds	420	246	101
Non-cash investing and financing activities			
Property and equipment additions included in accrued expenses and accounts payable	$ 772	$ 6,297	$ 2,011
Operating lease right-of-use assets obtained in exchange for operating lease liabilities	6,676	21,367	33,617
Issuance of common stock in connection with the business acquisition	5,860	77,122	26,773
Conversion of convertible notes	3,711	—	—

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

1. Organization, liquidity and capital resources

Twist Bioscience Corporation (the "Company") was incorporated in the state of Delaware on February 4, 2013. The Company is a synthetic biology company that has developed a disruptive DNA synthesis platform. DNA is used in many applications across different industries: industrial chemicals/materials, academic, healthcare and food/agriculture.

The core of the Company's platform is a proprietary technology that pioneers a new method of manufacturing synthetic DNA by "writing" DNA on a silicon chip. The Company has combined this technology with proprietary software, scalable commercial infrastructure and an e-commerce platform to create an integrated technology platform that enables the Company to achieve high levels of quality, precision, automation, and manufacturing throughput at a significantly lower cost than its competitors. The Company is leveraging its unique technology to manufacture a broad range of synthetic DNA-based products, including synthetic genes, tools for next generation sample preparation, and antibody libraries for drug discovery and development.

The Company has a limited operating history and its prospects are subject to risks, expenses and uncertainties frequently encountered by companies in this industry. These risks include, but are not limited to, the uncertainty of availability of additional financing, market acceptance of its products, the ability to retain and attract new customers, and the uncertainty of achieving future profitability.

The Company has generated net losses in all periods since inception. As of September 30, 2023, the Company had an accumulated deficit of $1,033.0 million and has not generated positive cash flows from operations since inception. Losses are expected to continue as the Company continues to invest in product development, manufacturing, and sales and marketing.

Since its inception, the Company has received an aggregate of $1,333.7 million in net proceeds from the issuance of equity securities and an aggregate of $13.8 million from debt. As of September 30, 2023, the Company had cash, cash equivalents, and short-term investments of $336.4 million, which the management believes will be sufficient to fund operations for at least one year from the issuance of these consolidated financial statements. However, if the Company needs to obtain additional financing to fund operations beyond this period, there can be no assurance that it will be successful in raising additional financing on terms which are acceptable to the Company.

2. Summary of significant accounting policies

Basis of presentation and use of estimates

The presentation of consolidated financial statements in conformity with accounting principles generally accepted in the United States requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities as of the date of the consolidated financial statements and the reported amounts of revenue and expenses during the reporting period. Such estimates include the valuation of deferred tax assets, stock-based compensation expense, transaction price and progress toward completion of performance obligation under the contracts with customers, determination of the net realizable value of inventory, valuation and useful life of developed technology and customer relationships, restructuring costs and incremental borrowing rate for operating leases. Actual results could differ from those estimates. Certain prior year amounts have been reclassified to conform to the current year presentation. The Company's consolidated financial statements include its wholly-owned subsidiaries and Revelar, a variable interest entity ("VIE") for which the Company was the primary beneficiary through September 30, 2022. Refer to Note 15 for details. All intercompany balances and accounts are eliminated in consolidation.

Risks and uncertainties

The Company relies on third parties for the supply and manufacture of its products, including a single-source supplier for a critical component, as well as third-party logistics providers. In instances where these parties fail to perform their obligations, the Company may be unable to find alternative suppliers to satisfactorily deliver its products to its customers on time, if at all.

The Company operates in a dynamic and highly competitive industry and believes that changes in any of the following areas could have a material adverse effect on the Company's future financial position, results of operations, or cash flows: ability to obtain future financing; advances and trends in new technologies and industry standards; market acceptance of the Company's products; development of sales channels; certain strategic relationships; litigation or claims against the

Company regarding intellectual property, patent, product, regulatory, or other factors; and the ability to attract and retain employees necessary to support its growth.

The Company has expended and expects to continue to expend substantial funds to complete the research and development. The Company may require additional funds to commercialize its products and may be unable to entirely fund these efforts with its current financial resources. Additional funds may not be available on acceptable terms, if at all. If adequate funds are unavailable on a timely basis from operations or additional sources of financing, the Company may have to delay the sale of the Company's products and services which would materially and adversely affect its business, financial condition and operations.

During the year ended September 30, 2023, financial results of the Company were not significantly affected by the COVID 19 pandemic, which continues to have global impact. The Company has considered all information available as of the date of issuance of these financial statements and the Company is not aware of any specific events or circumstances that would require an update to its estimates or judgments, or a revision to the carrying value of its assets or liabilities. These estimates may change as new events occur and additional information becomes available. The extent to which the COVID 19 outbreak affects the Company's future financial results and operations will depend on future developments which continue to evolve and are difficult to predict, including new information concerning mutations in the SARS-CoV 2 virus, which may make it more contagious, and current or future domestic and international actions to contain it and treat it.

Concentration of credit risk

Financial instruments that potentially subject the Company to a concentration of credit risk consist of cash and cash equivalents, short-term investments and accounts receivable. Substantially all of the Company's cash is held with two financial institutions that management believe are of high credit quality. Such deposits may, at times, exceed federally insured limits. The Company's investment policy addresses the level of credit exposure by establishing a minimum allowable credit rating and by limiting the concentration in any one investment.

The Company's accounts receivable is derived from customers located principally in the United States and Europe. The Company performs ongoing credit evaluations of its customers and maintains allowances for potential credit losses on customers' accounts when deemed necessary. The Company does not typically require collateral from its customers. Credit losses historically have not been material. The Company continuously monitors customer payments and maintains an allowance for doubtful accounts based on its assessment of various factors including historical experience, age of the receivable balances, and other current economic conditions or other factors that may affect customers' ability to pay.

Customer concentration

There are no major customers who accounted for 10% or more of the Company's revenue for the fiscal year ended September 30, 2023, September 30, 2022 and September 30, 2021.

There is one customer who accounted for 10% or more of the net accounts receivable as of September 30, 2023. There were no major customers who accounted for 10% or more of the net accounts receivable as of September 30, 2022.

Cash and cash equivalents and restricted cash

Cash equivalents that are readily convertible to cash are stated at cost, which approximates fair value. The Company considers all highly liquid investments with an original or remaining maturity of three months or less at the time of purchase to be cash equivalents. Cash equivalents consist of investments in money market funds as of September 30, 2023 and 2022.

Restricted cash represents cash held at financial institutions that are pledged as collateral for stand-by letters of credit for lease commitments. The lease related letters of credit will lapse at the end of the respective lease terms through 2044.

(in thousands)	September 30, 2023	September 30, 2022
Cash and cash equivalents	$ 286,470	$ 378,687
Restricted cash, non-current	2,811	1,572
Total cash, cash equivalents and restricted cash	$ 289,281	$ 380,259

Short-term investments

The Company invests in various types of securities, including United States government, commercial paper, and corporate debt securities. It classifies its investments as available-for-sale and records them at fair value based upon market prices at period end. Unrealized gains and losses that are deemed temporary in nature are recorded in accumulated other comprehensive income as a separate component of stockholders' equity. Dividend and interest income are recognized when earned. Realized gains and losses are included in earnings and are derived using the specific identification method for determining the cost of investments sold. The Company may sell these securities at any time for use in current operations.

Accounts receivable

Trade receivables include amounts billed and currently due from customers, recorded at the net invoice value and are not interest bearing. The amounts due are stated at their net estimated realizable value. The Company maintains an allowance for doubtful accounts to provide for the estimated amounts of receivables that will not be collected. The allowance is based upon an assessment of customer creditworthiness, historical payment experience, the age of outstanding receivables and collateral to the extent applicable.

The Company re-evaluates such allowance on a regular basis and adjusts its allowance as needed. Once a receivable is deemed to be uncollectible, such balance is charged against the allowance. Provision for bad debts were $0.2 million and $0.2 million as of September 30, 2023 and 2022, respectively.

The Company has a short order-to-invoice lifecycle, as most products can be manufactured within one month. Upon delivery of the products to the customer, the Company invoices the customer. The typical timing of payment is net 30 days.

Fair value of financial instruments

The Company applies fair value accounting for all financial and non-financial assets and liabilities that are recognized or disclosed at fair value in the financial statements on a recurring basis. The Company defines fair value as the price that would be received from selling an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. When determining the fair value measurements for assets and liabilities which are required to be recorded at fair value, we consider the principal or most advantageous market in which we would transact and the market-based risk measurements or assumptions that market participants would use in pricing the asset or liability, such as risks inherent in valuation techniques, transfer restrictions and credit risks. See Note 3, Fair value measurements, for more information. The carrying amounts of the Company's financial instruments including cash equivalents, short term investments, and accounts receivable approximate fair value due to their relatively short maturities.

Inventories

Inventories are stated at the lower of cost or net realizable value. Cost is computed using standard cost which approximates actual cost on a first-in, first-out basis. The Company periodically review its inventories to identify obsolete, slow-moving, excess or otherwise unsaleable items. If obsolete, slow-moving, excess or unsaleable items are observed and there are no alternate uses for the inventory, the Company records a write-down to net realizable value through a charge to cost of revenues on our consolidated statements of operations and comprehensive loss. The determination of net realizable value requires judgment, including consideration of many factors, such as estimates of future product demand, past experience, product net selling prices, current and future market conditions, the age and nature of inventories, and potential product obsolescence, among others.

Property and equipment

Property and equipment are stated at cost less accumulated depreciation and amortization. Depreciation and amortization are computed using the straight-line method over the estimated useful lives of the assets or the lesser of the useful life and the remaining lease term of the respective leasehold improvements assets, if any. Upon retirement or sale, the cost of assets disposed of and the related accumulated depreciation are eliminated from the accounts and any resulting gain or loss is credited or charged to operations in the period recognized. Repairs and maintenance costs are expensed as incurred.

The Company recorded depreciation and amortization expense of $29.3 million, $16.5 million, and $9.8 million for the years ended September 30, 2023, 2022 and 2021, respectively. Estimated lives of property and equipment are as follows:

Laboratory equipment	5 Years
Furniture, fixtures and other equipment	5 Years
Computer equipment	3 Years
Vehicles	5 Years
Computer software	3 Years
Leasehold improvements	Lesser of useful life or facilities' lease term

Capitalized software development costs

Costs associated with internal-use software systems, including those to improve e-commerce capabilities, during the application development stage are capitalized. Capitalization of costs begins when the preliminary project stage is completed, management has committed to funding the project, and it is probable that the project will be completed and the software will be used to perform the function intended. Costs include external direct costs of services and applicable personnel costs of employees devoted to specific software application development. Personnel costs consist of salaries, employee benefit costs, bonuses and stock-based compensation expenses. The capitalized amounts are included in property and equipment, net on the consolidated balance sheets.

Capitalization ceases at the point when the project is substantially complete and is ready for its intended purpose. The capitalized amounts are included in property and equipment, net on the consolidated balance sheets.
Capitalized software development costs were $7.9 million and $5.3 million as of September 30, 2023 and 2022, respectively. Capitalized costs are amortized from the project completion date, using the straight-line method over an estimated useful life of the assets.

Finite-lived intangible assets

Finite-lived intangible assets are recorded at cost, net of accumulated amortization, and, if applicable, impairment charges. Amortization of finite-lived intangible assets is recorded over the assets' estimated useful lives on a straight-line basis or based on the pattern in which economic benefits are consumed, if reliably determinable. The Company reviews the finite-lived intangible assets for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable. See "Impairment of long-lived assets" for additional information.

Impairment of long-lived assets

The Company reviews property and equipment, right of use assets and finite-lived intangible assets for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable. If indicators of impairment are present, the Company tests for recoverability by comparing the estimated undiscounted future cash flows expected to result from the use of the asset over its useful life to the carrying amount of the asset or asset group. If the asset or asset group is determined to be impaired, any excess of the carrying value of the asset or asset group over its estimated fair value is recognized as an impairment loss. Impairment assessments inherently involve judgment as to assumptions about expected future cash flows and the impact of market conditions on those assumptions. See Note 14 for the impairment of property and equipment during the year ended September 30, 2023. There were no impairments of long-lived assets during the years ended September 30, 2022 and 2021.

Leases

The Company determines if an arrangement is or contains a lease at inception and classify each lease as operating or financing. Operating lease right-of-use assets represent the Company's right to use an underlying asset for the lease term and lease liabilities represent the Company's obligation to make lease payments made during the lease term, net of any tenant improvement allowance. Operating lease right-of-use assets and liabilities are recognized at the lease commencement date based on the present value of lease payments over the lease term. In determining the present value of committed lease payments, the Company uses its incremental borrowing rate based on the information available at the lease commencement date which includes significant assumptions made including the Company's estimated credit rating, annual percentage yields from corporate debt financings of companies of similar size and credit rating over a loan term approximating the remaining term of each lease, and government bond yields for terms approximating the remaining term of each lease in countries where the leased assets are located. Certain leases include payments of operating expenses that are dependent on the landlord's estimate, and these variable payments are therefore excluded from the lease payments used to determine the operating lease right-of-use asset and lease liability. Lease terms may include options to extend or terminate the lease when it is reasonably certain that the Company will exercise any such options. Operating lease right-of-

use assets are adjusted for prepaid lease payments, lease incentives and initial direct costs incurred. Lease expense is recognized on a straight-line basis over the expected lease term.

The Company elected to not apply the recognition requirements of Topic 842 to short-term leases with terms of 12 months or less which do not include an option to purchase the underlying asset that the Company is reasonably certain to exercise. For short-term leases, lease payments are recognized as operating expenses on a straight-line basis over the lease term. The Company elected to account for lease and non-lease components as a single lease component.

Additional information and disclosures required by Topic 842 are contained in Note 6.

Goodwill

Determining when to test for impairment, the reporting unit, the assets and liabilities of the reporting unit, and the fair value of the reporting unit requires significant judgment and involves the use of significant estimates and assumptions. The Company tests goodwill for impairment in the fourth quarter each year, or more frequently if indicators of an impairment exist. Evaluating goodwill for impairment involves the determination of the fair value of the reporting unit in which goodwill and indefinite-lived intangible assets are recorded using a qualitative or quantitative analysis. If the fair value of the reporting unit exceeds its carrying value, goodwill is considered not impaired. If the carrying value of the reporting unit exceeds its fair value, the Company will record an impairment loss up to the difference between the carrying value and implied fair value.

The Company has an unconditional option to bypass the qualitative assessment in any period and proceed directly to performing the first step of the goodwill impairment test. For 2023, the Company elected to proceed directly to the step-one assessment which indicated that the fair value of its single reporting unit substantially exceeded the carrying value.

Segment information

The Company is a synthetic biology and genomics company that has developed a disruptive DNA synthesis platform to industrialize the engineering of biology and manufactures synthetic genes, tools for next-generation sequencing preparation, and antibody libraries for drug discovery and development and operates as one reportable and operating segment. The Company's chief operating decision-maker, its Chief Executive Officer (CEO), reviews the Company's operating results on an aggregate basis for purposes of allocating resources and evaluating financial performance.

Foreign currency transactions and translation

The Company's consolidated financial statements are presented in U.S. dollars. The functional currency for certain foreign subsidiaries is their local currency. Revenues, expenses, gains and losses for non-U.S. dollar functional currency entities are translated into U.S. dollars using average currency exchange rates for the period. Assets and liabilities for such entities are translated using exchange rates that approximate the rate at the balance sheet date. Foreign currency translation adjustments are recorded as a component of accumulated other comprehensive income on the Company's consolidated balance sheets. Foreign currency transaction gains and losses on transactions not denominated in functional currency are recorded in Other income (expense), net, on the consolidated statements of operations.

Revenue recognition

The Company's revenue is generated through the sale of synthetic biology tools, such as synthetic genes, oligo pools, next generation sequencing tools, and DNA and biopharma libraries. The Company recognizes revenue when control of the products is transferred to the customer and at a transaction price that is determined based on the agreed upon rates in the applicable order or master supply agreement applied to the quantity of synthetic DNA that was manufactured and shipped to the customer.

Contracts with customers are in the written form of a purchase order or a quotation, which outline the promised goods and the agreed upon price. Such orders may be accompanied by a Master Supply or Distribution Agreement that establishes the terms and conditions, rights of the parties, delivery terms, and pricing. The Company assesses collectability based on a number of factors, including past transaction history and creditworthiness of the customer.

The transaction price is determined based on the agreed upon rates in the purchase order or master supply agreements applied to the quantity of all the products that were manufactured and shipped to the customer. The Company's contracts may include one or more ordered products, and the shipment of these products comprises the performance obligation(s) under the contract. Accordingly, all of the transaction price, net of any discounts, is allocated to the one performance obligation. The Company's sales are subject to Ex Works (as defined in Incoterms 2010) delivery terms and revenue, other than Biopharma revenue, is recorded at the point in time when products are picked up by the customer's freight forwarder, as the Company has determined that this is the point in time that control transfers to the customer. Therefore, upon

shipment of the product, there are no remaining performance obligations. The Company's shipping and handling activities are performed before the customer obtains control of the goods and therefore are considered a fulfillment cost. Shipping and handling fees charged to our customers are recognized as product revenue in the period shipped and the related costs for providing these services are recorded as a cost of revenue. The Company has elected to exclude all sales and value added taxes from the measurement of the transaction price. The Company has not adjusted the transaction price for significant financing since the time period between the transfer of goods and payment is less than one year. The Company has elected the practical expedient to not disclose the consideration allocated to remaining performance obligations and an explanation of when those amounts are expected to be recognized as revenue since the duration of the contracts is less than one year.

The Company's Biopharma revenue currently primarily consists of research and development agreements with third parties that provide for up-front and milestone-based payments. The Company also enters into research and development agreements that do not include up-front or milestone-based payments and recognizes revenue on these types of agreements based on the timing of development activities. The Company's research and development agreements may include more than one performance obligation. At the inception of the agreement, the Company assesses whether each obligation represents a separate performance obligation or whether such obligations should be combined as a single performance obligation. The transaction price for each agreement is determined based on the amount of consideration the Company expects to be entitled to for satisfying all performance obligations within the agreement. The Company assesses the nature of the combined performance obligation to determine whether the combined performance obligation is satisfied over time or at a point in time and, if over time, the appropriate method of measuring progress for purposes of recognizing revenue. In agreements where the Company satisfies performance obligation(s) over time, the Company recognizes development revenue typically using an input method based on costs incurred relative to the total expected cost which determines the extent of progress toward completion. As part of the accounting for these arrangements, the Company must develop estimates and assumptions that require judgment to determine the transaction price and progress towards completion. The Company reviews its estimate of the transaction price and progress toward completion based on the best information available to recognize the cumulative progress toward completion as of the end of each reporting period and makes revisions to such estimates as necessary. Also, these research and development agreements may include license payments. The Company recognizes revenue from functional license agreements when the license is transferred to the customer and the customer is able to use and benefit from the license. Functional license has significant standalone functionality because it can be used as is for performing a specific task.

The Company had contract assets of $2.8 million and contract liabilities of $3.0 million as of September 30, 2023. The Company had contract assets of $3.4 million and contract liabilities of $3.5 million as of September 30, 2022. For the years ended September 30, 2023 and 2022, the Company recognized revenue of $2.8 million and $1.1 million, respectively, from the amount that was included in the contract liability balance at the beginning of each year. For the year ended September 30, 2021, the Company did not recognize revenue from amounts that was included in the contract liability balance at the beginning of the period. In addition, for all periods presented, there was no revenue recognized in a reporting period from performance obligations satisfied in previous periods. The aggregate amount of the transaction price allocated to the performance obligations that are unsatisfied as of September 30, 2023 was $5.3 million. The Company expects to recognize revenue over the next twelve months relating to performance obligations unsatisfied as of September 30, 2023.

Based on the nature of the Company's contracts with customers which are recognized over a term of less than 12 months, the Company has elected to use the practical expedient whereby costs to obtain a contract are expensed as they are incurred.

The Company states its revenues net of any taxes collected from customers that are required to be remitted to various government agencies. The amount of taxes collected from customers and payable to governmental entities is included on the balance sheet as part of "Accrued expenses and other current liabilities."

Refer to Note 12 for the disaggregation of revenues by geography, by product and by industry.

Research and development

Research and development expenses consist of compensation costs, employee benefits, subcontractors, research supplies, allocated facility related expenses and allocated depreciation and amortization. All research and development costs are expensed as incurred.

Advertising costs

Costs related to advertising and promotions are expensed to sales and marketing as incurred. Advertising and promotion expenses for the years ended September 30, 2023, 2022 and 2021, were $2.9 million, $2.4 million and $2.5 million, respectively.

Government contract payments

The Company had a subcontract with the Georgia Institute of Technology funded by the United States Director of Central Intelligence ("IARPA"). This subcontract was for the period from September 2019 to February 2023. The Company recognized payments received from these arrangements when milestones are achieved and recorded them as a reduction of research and development expenses. The total cost for the IARPA development project was $7.7 million with IARPA funding $5.7 million and the Company was responsible for providing a minimum contribution of $2.0 million. In fiscal year 2023, 2022, and 2021, the Company received IARPA payments of $1.2 million, $0.9 million, and $1.1 million, respectively.

Stock-based compensation

The Company maintains performance incentive plans under which incentive and nonqualified stock options, performance-based stock options, restricted stock units, performance-based stock units and through employer purchase plan are granted primarily to employees and may be granted to members of the board of directors and certain non-employee consultants, and employees may participate in an employee stock purchase plan.

The Company recognizes stock compensation in accordance with the Accounting Standard Codification ("ASC") 718, *Compensation—Stock Compensation*. ASC 718 requires the recognition of compensation expense, using a fair value-based method, for costs related to all stock-based payments including stock options, restricted stock units and employee stock purchase plan.

The Company recognizes fair value of stock options granted to employees and non-employees as a stock-based compensation expense over the period in which the related services are received. The Company recognizes forfeitures as they occur. The Company believes that the estimated fair value of stock options is more readily measurable than the fair value of the services rendered.

For performance-based awards, expense is recognized over the period from the grant date to the estimated attainment date, which is the derived service period of the award, if management determines that it is probable that the performance-based vesting conditions will be achieved.

Net loss per share attributable to common stockholders

The Company calculates its basic and diluted net loss per share attributable to common stockholders in conformity with the two-class method required for companies with participating securities. In computing diluted net loss attributable to common stockholders, undistributed earnings are re-allocated to reflect the potential impact of dilutive securities. For purposes of the calculation of diluted net loss per share attributable to common stockholders, unvested shares of common stock issued upon the early exercise of stock options, shares issuable for employee stock purchase plan contributions received, warrants to purchase common stock, unvested restricted common stock, unvested restricted stock units and stock options to purchase common stock are considered potentially dilutive securities but have been excluded from the calculation of diluted net loss per share attributable to common stockholders as their effect is antidilutive.

Basic and diluted net loss per share of common stock attributable to common stockholders is calculated by dividing the net loss attributable to common stockholders by the weighted-average number of shares of common stock outstanding during the period, less shares subject to repurchase, and excludes any dilutive effects of employee stock-based awards and warrants. Because the Company has reported a net loss for the years ended September 30, 2023, 2022 and 2021, diluted net loss per common share is the same as the basic net loss per share for those years.

Income taxes

The Company accounts for income taxes using the asset and liability method whereby deferred tax asset and liability accounts are determined based on differences between financial reporting and tax bases of assets and liabilities and are measured using the enacted tax rates and laws that are currently in effect. Valuation allowances are established where necessary to reduce deferred tax assets to the amounts expected to be realized.

In fiscal 2022, the Company began recognizing an additional component of total Federal tax expense, the tax on Global Intangible Low-Taxed Income (“GILTI”) provision of the Tax Act, which became applicable to the Company in fiscal 2022. The Company elected to account for GILTI as a period cost, and therefore included GILTI expense in the effective tax rate calculation. This provision did not have a material effect on the effective tax rate for the years ended September 30, 2023, 2022 and 2021.

Variable interest entities

The Company consolidates a VIE in which the Company is deemed to be the primary beneficiary. An entity is generally a VIE if it meets any of the following criteria: (i) the entity has insufficient equity to finance its activities without additional subordinated financial support from other parties, (ii) the equity investors cannot make significant decisions about the entity's operations or (iii) the voting rights of some investors are not proportional to their obligations to absorb the expected losses of the entity or receive the expected returns of the entity and substantially all of the entity's activities involve or are conducted on behalf of the investor with disproportionately few voting rights. The Company periodically makes judgments in determining whether its investees are VIEs and, for each reporting period, the Company assesses whether it is the primary beneficiary of its VIE.

Business combinations

The Company accounts for business combinations using the acquisition method.
Under the acquisition method, the purchase price of the acquisition is allocated to the acquired tangible and identifiable intangible assets and assumed liabilities based on their estimated fair values at the time of the acquisition. This allocation involves a number of assumptions, estimates, and judgments that could materially affect the timing or amounts recognized in the Company's financial statements. As a result, the Company may record adjustments to the fair values of assets acquired and liabilities assumed within the measurement period (up to one year from the acquisition date) with the corresponding offset to goodwill. The most subjective areas of the acquisition accounting method include determining the fair value of the following:

- identifiable intangible assets, including the valuation methodology, estimates of projected revenues, technology obsolescence, and discount rates, as well as the estimated useful life of the intangible assets;
- contingent consideration; and
- goodwill, as measured as the excess of consideration transferred over the acquisition date fair value of the assets acquired, including the amount assigned to identifiable intangible assets, and the liabilities assumed.

The assumptions and estimates are based upon comparable market data and information obtained from the management of the acquired business.

Goodwill is assigned to reporting units that are expected to benefit from the synergies of the business combination as of the acquisition date.

Identifiable intangible assets with finite lives are amortized over their estimated useful lives in a pattern in which the asset is consumed. Acquisition-related costs, including advisory, legal, accounting, valuation, and other similar costs, are expensed in the periods in which those costs are incurred. The results of operations of acquired businesses are included in the Company's consolidated financial statements from the acquisition date.

Restructuring and other costs

Restructuring and other costs are comprised of employee separation costs, asset impairments, and other associated costs primarily related to implementing the plan. Employee separation costs principally consist of one-time termination benefits and contractual termination benefits for severance, other termination benefit costs, and stock-based compensation expense for the acceleration of stock awards.

The Company records restructuring charges based on whether the termination benefits are provided under an on-going benefit arrangement or under a one-time benefit arrangement. The Company accounts for on-going benefit arrangements, such as those documented by employment agreements, in accordance with ASC 712, Nonretirement Postemployment Benefits. Under ASC 712, liabilities for post employment benefits are recorded at the time the obligations are probable of being incurred and can be reasonably estimated. The Company accounts for one-time employment benefit arrangements in accordance with ASC 420 Exit or Disposal Cost Obligations. One-time termination benefits are expensed at the date the entity notifies the employee, unless the employee must provide future service, in which case the benefits are expensed ratably over the future service period. Other associated costs are recognized in the period in which the liability is incurred. The Company recognized losses on disposal of property and equipment, which was accounted in accordance with ASC 360, Impairment of Long-Lived Assets.

Recent accounting pronouncements

New accounting guidance adopted

In November 2021, the Financial Accounting Standards Board (the "FASB") issued ASU 2021-10, Government Assistance (Topic 832): Disclosures by Business Entities about Government Assistance. The amendments in this update require the annual disclosures about transactions with a government that are accounted for by applying a grant or contribution accounting model. The Company adopted this standard effective October 1, 2022. The adoption of ASU-2021-10 did not have an impact on the Company's consolidated financial statements as of and for the year ended September 30, 2023.

New accounting guidance issued but not yet effective

In June 2016, the FASB issued ASU 2016-13, Financial Instruments—Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments. The new standard requires entities to use the new "expected credit loss" impairment model for most financial assets measured at amortized cost, including trade and other receivables and held-to-maturity debt securities, and modifies the impairment model for available-for-sale debt securities. The standard is effective for the Company for the fiscal year ending September 30, 2024, including interim periods within that fiscal year. Early application is permitted. The standard is not expected to have a material impact to the Company's consolidated financial statements.

3. Fair value measurement

The Company determines the fair value of financial and non-financial assets and liabilities using the fair value hierarchy which requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value. The standard describes three levels of inputs that may be used to measure fair value:

Level 1—Quoted prices in active markets for identical assets or liabilities.

Level 2—Observable inputs other than Level 1 prices such as quoted prices for similar assets or liabilities, quoted prices in markets that are not active, or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the assets or liabilities.

Level 3—Unobservable inputs that are supported by little or no market activity and that are significant to the fair value of the assets or liabilities.

In determining fair value, the Company utilizes valuation techniques that maximize the use of observable inputs and minimize the use of unobservable inputs to the extent possible as well as considering counterparty credit risk in its assessment of fair value.

The following table sets forth the cash and cash equivalents, and short-term investments as of September 30, 2023:

(in thousands)	Amortized cost	Gross unrealized gains	Gross unrealized losses	Fair value
Cash and cash equivalents	$ 286,470	$ —	$ —	$ 286,470
Short-term investments:				
Corporate Bonds	14,918	—	(29)	14,889
U.S. government treasury bills	35,111	—	(57)	35,054
Non-current assets - investment in equity securities	3,711	—	—	3,711
Total	$ 340,210	$ —	$ (86)	$ 340,124

The following table sets forth the cash and cash equivalents, and short-term investments as of September 30, 2022:

(in thousands)	Amortized cost	Gross unrealized gains	Gross unrealized losses	Fair value
Cash and cash equivalents	$ 378,687	$ —	$ —	$ 378,687
Short-term investments:				
Commercial paper	14,997	—	—	14,997
U.S. government treasury bills	112,878	—	(1,594)	111,284
Total	$ 506,562	$ —	$ (1,594)	$ 504,968

As of September 30, 2023, financial assets and liabilities measured and recognized at fair value are as follows:

(in thousands)	Level 1	Level 2	Level 3	Fair value
Assets				
Money market funds	$ 245,654	$ —	$ —	$ 245,654
Corporate Bonds	—	14,889	—	14,889
U.S. government treasury bills	35,054	—	—	35,054
Investment in equity securities	—	—	3,711	3,711
Total financial assets	$ 280,708	$ 14,889	$ 3,711	$ 299,308
Total financial liabilities	$ —	$ —	$ —	$ —

As of September 30, 2022, financial assets and liabilities measured and recognized at fair value are as follows:

(in thousands)	Level 1	Level 2	Level 3	Fair value
Assets				
Money market funds	$ 316,805	$ —	$ —	$ 316,805
Commercial paper	—	14,997	—	14,997
U.S. government treasury bills	111,284	—	—	111,284
Total financial assets	$ 428,089	$ 14,997	$ —	$ 443,086
Liabilities				
Contingent consideration and indemnity holdback	$ —	$ 9,592	$ 2,100	$ 11,692
Total financial liabilities	$ —	$ 9,592	$ 2,100	$ 11,692

Contractual maturities of short-term investments, as of September 30, 2023, were less than 12 months. The Company does not intend to sell the money market funds and short term investments and it is not more likely than not that the Company will be required to sell the investments before recovery of their amortized cost basis. The unrealized loss on short-term investments have been in a continuous unrealized loss position for less than 12 months.

During 2021 and as amended in 2022, the Company entered into convertible promissory note agreements with a privately held company ("Borrower") pursuant to which the Company agreed to loan to the Borrower $3.5 million in a series of loan installments, evidenced by a convertible promissory note having a maturity date of May 1, 2023 ("Convertible Note"). The Convertible Note included an option to convert the Convertible note into the Borrower's equity at the Borrower's next round of equity financing, and accrued interest at a rate of 4% per annum. In April 2023, the Company exercised the option and the Borrower issued to the Company ordinary shares which represent a 15% equity interest. As of September 30, 2023, the Company's equity investments were categorized as Level 3 within the fair value hierarchy.

The equity investment held by the company is a VIE, but the Company is not the primary beneficiary. The Company does not have the power to direct the activities that most significantly impact the economic performance of the investee. The Company's maximum exposure to loss from this VIE consist of equity investment of $3.7 million**.** Equity investments held by the Company lack readily determinable fair values and therefore the securities are measured at cost minus impairment, if any, plus or minus changes resulting from observable price changes in orderly transactions for the identical or similar equity securities of the same issuer. The Company reviews the carrying value of its equity investments for impairment whenever events or changes in business circumstances indicate the carrying amount of such asset may not be fully

recoverable. Impairments, if any, are based on the excess of the carrying amount over the recoverable amount of the asset. There were no such impairments during the years ended September 30, 2023, 2022 and 2021. Because of the inherent uncertainty of valuation, the estimated fair value of our financial instruments may differ significantly from the values that would have been used had a ready market for the financial instruments existed, and the differences could be material to our consolidated financial statements.

As of September 30, 2022, the Company's contingent consideration related to its Abveris acquisition was categorized as Level 3 within the fair value hierarchy. Contingent consideration was classified as a liability and was remeasured to an estimated fair value at each reporting date until the contingency is resolved. Contingent consideration was recorded at its fair values using unobservable inputs and have included using the Monte Carlo simulation option pricing framework, incorporating contractual terms and assumptions regarding financial forecasts, discount rates, and volatility of forecasted revenue. The key assumptions was calendar year 2023 revenue forecast and the Company's share price. The development and determination of the unobservable inputs for Level 3 fair value measurements and fair value calculations are the responsibility of the Company's management with the assistance of a third-party valuation specialist.

At September 30, 2022, management determined that the revenue target for the calendar year 2022 was probable of being achieved and a contingent consideration liability of $2.1 million was recognized. At December 31, 2022, management determined that the revenue target for the calendar year 2022 was not achieved, and therefore, a change in fair value of contingent consideration of $2.1 million was recognized, resulting in the extinguishment of the contingent consideration liability of $2.1 million.

The key inputs into the Monte Carlo simulation as of December 1, 2021, the acquisition date and as of September 30, 2022 were as follows:

Contingent consideration	September 30, 2022	December 1, 2021
Stock price	$ 35.24	$ 87.06
Equity volatility	93.7 %	81.3 %
Risk-free interest rate	3.9 %	0.4 %
Revenue volatility	30.2 %	21.9 %

There were no transfers between Level 1, Level 2 and Level 3 in the periods presented. The following table provides a reconciliation of beginning and ending balances of the Level 3 financial liabilities during the year ended September 30, 2023:

(in thousands)	Contingent consideration	Equity investments	Total
Balance as of September 30, 2022	$ 2,100	$ —	$ 2,100
Change in fair value	(2,100)	—	(2,100)
Additions during the year	—	3,711	3,711
Balance as of September 30, 2023	$ —	$ 3,711	$ 3,711

4. Balance sheet components

Inventories consist of the following:

(in thousands)	September 30, 2023	2022
Raw Materials	$ 27,024	$ 28,787
Work-in-process	1,113	2,866
Finished Goods	3,926	7,654
	$ 32,063	$ 39,307

There is no consigned inventory balance as of September 30, 2023. The work-in-process inventory included consigned inventory of $0.1 million as of September 30, 2022.

Property and Equipment, net consists of the following:

	September 30,	
(in thousands)	2023	2022
Laboratory equipment	$ 104,508	$ 62,285
Furniture, fixtures and other equipment	3,484	2,332
Vehicles	85	—
Computer equipment	3,103	2,815
Computer software	5,507	1,693
Leasehold improvements	57,271	14,371
Construction in progress	8,528	87,723
	$ 182,486	$ 171,218
Less: Accumulated depreciation and amortization	(50,656)	(31,777)
	$ 131,830	$ 139,441

Construction in progress mainly represents equipment costs and software development costs. During the year, the Company recognized impairment of property and equipment of $6.8 million. See Note 14 for details.

Other current liabilities

Other current liabilities consist of the following:

	September 30,	
(in thousands)	2023	2022
Income and other taxes payable	$ 4,374	$ 3,661
Deferred revenue	2,999	3,476
Other current liabilities	430	908
Contingent consideration	—	2,100
Indemnity holdbacks	—	9,592
	$ 7,803	$ 19,737

5. Goodwill and intangible assets

Total amortization expense related to intangible assets was $5.3 million, $4.9 million, and $0.5 million for the years ended September 30, 2023, 2022 and 2021, respectively.

The goodwill balance is presented below:

(in thousands)	September 30,	
	2023	2022
Balance at beginning of year	85,811	22,434
Business acquisition – additions (see Note 13)	—	61,768
Remeasurement adjustments to the deferred tax assets	—	1,609
Balance at end of year	$ 85,811	$ 85,811

The finite-lived intangible assets balances are presented below:

(in thousands, except for years)	September 30, 2023 Weighted average Amortization period in years	Gross carrying amount	Accumulated amortization	Net book value
Developed Technology	15	$ 50,020	$ (7,636)	$ 42,384
Customer Relationships	11	15,210	(3,461)	11,749
Tradenames & Trademarks	3	900	(550)	350
Total finite-lived intangible assets		$ 66,130	$ (11,647)	$ 54,483

(in thousands, except for years)	September 30, 2022 Weighted average Amortization period in years	Gross carrying amount	Accumulated amortization	Net book value
Developed Technology	15	$ 50,020	$ (4,375)	$ 45,645
Customer Relationships	11	15,210	(1,767)	13,443
Tradenames & Trademarks	3	900	(250)	650
Total finite-lived intangible assets		$ 66,130	$ (6,392)	$ 59,738

Future annual amortization expense is as follows (in thousands):

Years ending September 30,	
2024	$ 5,170
2025	4,920
2026	4,870
2027	4,320
2028	4,210
Thereafter	30,993
	$ 54,483

6. Commitments and contingencies

Legal Proceedings

The Company may be subject to litigation, claims and disputes in the ordinary course of business. There is an inherent risk in any litigation or dispute and no assurance can be given as to the outcome of any claims.

Securities Class Action

On December 12, 2022, a putative securities class action lawsuit captioned Peters v. Twist Bioscience Corporation, et al., Case No. 22-cv-08168 (N.D. Cal.) ("Securities Class Action") was filed in federal court in the Northern District of California ("Court") against the Company, its Chief Executive Officer, and its Chief Financial Officer (the "Defendants") alleging violations of federal securities laws. The Securities Class Action's claims are based in large part on allegations made in a report issued on November 15, 2022 by Scorpion Capital ("Scorpion Report") concerning, among other things, the Company's DNA chip technology and accounting practices. The initial complaint filed in the Securities Class Action alleges that various statements that the defendants made between December 13, 2019 and November 14, 2022 were materially false and misleading in light of the allegations in the Scorpion Report. The plaintiff who initiated the lawsuit sought to represent a class of shareholders who acquired shares of the Company's common stock between December 13, 2019 and November 14, 2022 and sought damages as well as certain other costs. On July 28, 2023, the Court appointed a new plaintiff, not the original plaintiff who filed the case, as lead plaintiff in the case and appointed a new law firm as lead counsel. On October 11, 2023, the lead plaintiff filed an amended complaint. The amended complaint is purportedly brought on behalf of all persons other than the Defendants who acquired the Company's securities between December 20, 2018 and November 15, 2022. The amended complaint alleges that certain statements regarding, among other things, the Company's DNA products and accounting practices were false and misleading.

This case remains in the preliminary stage. Given the inherent uncertainty of litigation and the legal standards that must be met, including class certification and success on the merits, the Company cannot express an opinion on the likelihood of an unfavorable outcome or on the amount or range of any potential loss. The Company and the other defendants intend to vigorously defend themselves against the claims asserted against them, and will be filing a motion to dismiss the amended complaint on December 6, 2023.

Derivative Action

On September 25, 2023, a shareholder derivative suit captioned Shumacher vs. Leproust et al., No. 1:23-cv-01048-UNA, was filed in the United States District Court for the District of Delaware against directors of the Company and an employee (the "Derivative Action"). The suit is based on substantially the same allegations in the Securities Class Action and seeks to recover, on behalf of the Company, damages to the Company arising from, among other things, the Securities Class Action. On November 13, 2023, the parties to the Derivative Action entered into a stipulation staying the Derivative Action pending resolution of the anticipated motion to dismiss the defendants will file in the Securities Class Action.

Indemnifications

In the ordinary course of business, the Company enters into agreements that may include indemnification provisions. Pursuant to such agreements, the Company may indemnify, hold harmless and defend the indemnified parties for losses suffered or incurred by the indemnified party. Some of the provisions will limit losses to those arising from third-party actions. In some cases, the indemnification will continue after the termination of the agreement. The maximum potential amount of future payments the Company could be required to make under these provisions is not determinable. To date, the Company has not incurred material costs to defend lawsuits or settle claims related to these indemnification provisions. From time to time, the Company has entered into indemnification agreements with its directors and officers that requires it to indemnify its directors and officers against liabilities that may arise by reason of their status or service as directors or officers to the fullest extent permitted by law. The Company also has directors' and officers' insurance.

Leases

The Company leases certain of its facilities under non-cancellable operating leases expiring at various dates through 2044. The Company is also responsible for utilities, maintenance, insurance, and property taxes under these leases. Our lease payments consist primarily of fixed rental payments for the right to use the underlying leased assets over the lease terms, as well as payments for common-area-maintenance and administrative services. We often receive customary incentives from our landlords, such as reimbursements for tenant improvements and rent abatement periods, which effectively reduce the total lease payments owed for these leases. Leases are classified as operating or financing at commencement. We do not have any material financing leases.

Certain leases include options to renew or terminate at the Company's discretion. The lease terms include periods covered by these options if it is reasonably certain the Company will renew or not terminate. The Company's lease agreements do not contain any material residual value guarantees or restrictive covenants.

Supplemental balance sheet information related to the Company's operating leases as of September 30, 2023 is as follows:

(in thousands)	September 30, 2023
Assets:	
Operating lease right-of-use-assets	$ 71,531
Current liabilities:	
Current portion of operating lease liabilities	$ 14,896
Noncurrent liabilities:	
Operating lease liabilities, net of current portion	$ 79,173

Future minimum lease payments under all non-cancelable operating leases as of September 30, 2023 are as follows:

(in thousands)	Operating leases
Years ending September 30:	
2024	$ 14,860
2025	14,924
2026	13,894
2027	8,371
2028	8,471
Thereafter	88,014
Total minimum lease payments	$ 148,534
Less: imputed interest	(54,465)
Total operating lease liabilities	$ 94,069
Less: current portion	(14,896)
Operating lease liabilities, net of current portion	$ 79,173

The statement of cash flows for the year ended September 30, 2023, include changes in right-of-use assets and operating lease liabilities of $3.4 million and $0.8 million, respectively. For the year ended September 30, 2022, changes in right-of-use assets and operating lease liabilities were $13.4 million and $33.5 million, respectively.

Operating lease expense was $16.2 million and $15.6 million for the years ended September 30, 2023 and 2022 respectively. Cash payments for amounts included in the measurement of operating lease liabilities for the year ended September 30, 2023 were $14.6 million. As of September 30, 2023, the weighted-average remaining lease term was 15.37 years and the weighted-average incremental borrowing rate was 6.54%.

On May 30, 2023, Abveris, the Company's subsidiary, entered into an amendment to its existing lease agreement for approximately 17,200 square-feet primarily consisting of two additional spaces located in Quincy, Massachusetts, to further expand operations. The term of the lease for both spaces ends on August 31, 2032. The Company has two options to extend the term for five years. The Company does not have reasonable certainty that these options will be exercised. Upon execution of the lease agreement, the Company provided the landlord an additional approximate $0.5 million irrevocable letter of credit as a security deposit. The annual base rent for premises A will increase by 2.0% each year for the first two years and then 2.75% for each year thereafter plus certain operating expenses. The annual base rent for premises B will increase by 2.75% each year, plus certain operating expenses. The Company has the right to sublease the facility, subject to landlord consent. The premises A and B lease commenced in June 2023 and August 2023, respectively. As of the lease commencement dates, the total future minimum lease payments under the agreement was $8.6 million.

7. Related party transactions

During the years ended September 30, 2023, 2022 and 2021, the Company purchased raw materials from related parties in the amount of $6.8 million, $8.0 million and $5.0 million, respectively. During the years ended September 30, 2023, and 2022, the Company had revenues from the related parties in the amount of $5.9 million and $3.5 million, respectively. The revenues from the related parties were immaterial for the year ended September 30, 2021. Payable balances with the related parties were immaterial as of September 30, 2023, 2022 and 2021. Receivable balances with the related parties were $1.7 million as of September 30, 2023, and immaterial as of September 30, 2022 and 2021. During the year ended September 30, 2022, the Company entered into a service agreement with a related party for the total consideration of $0.1 million.

8. Income taxes

The Company recorded provisions for income taxes of $1.2 million for the year ended September 30, 2023. The Company recorded an income tax benefit of $10.4 million and $1.9 million for the years ended September 30, 2022 and 2021, respectively.

The domestic and foreign components of pre-tax loss for the years ended September 30, 2023, 2022, and 2021 are as follows:

(in thousands)	Year ended September 30, 2023	2022	2021
US	$ (205,389)	$ (231,659)	$ (149,533)
Foreign	1,923	3,385	(4,495)
Total	$ (203,466)	$ (228,274)	$ (154,028)

The components of the provision for income taxes for the years ended September 30, 2023, 2022, and 2021 are as follows:

(in thousands)	Year ended September 30, 2023	2022	2021
Current			
Federal	$ —	$ —	$ —
State	9	(1)	(29)
Foreign	1,143	767	108
Total current	$ 1,152	$ 766	$ 79
Deferred			
Federal	$ —	$ (9,765)	$ (2,268)
State	—	(1,412)	259
Foreign	—	—	—
Total deferred	$ —	$ (11,177)	$ (2,009)
Total (benefit)/provision	$ 1,152	$ (10,411)	$ (1,930)

The following is a reconciliation of the statutory federal income tax rate to the Company's effective tax rate for the years ended September 30, 2023, 2022, and 2021:

	Year ended September 30, 2023	2022	2021
Tax expense computed at the federal statutory rate	21 %	21 %	21 %
Change in valuation allowance	(25)%	(13)%	(33)%
Research and development credit benefit	5 %	4 %	3 %
Business combination	— %	(4)%	(2)%
Stock-based compensation	(1)%	(1)%	12 %
Change in fair value of contingent consideration and holdbacks	1 %	(1)%	— %
Gain on deconsolidation of variable interest entity	— %	(1)%	— %
Others	(2)%	— %	— %
Total income tax expense	(1)%	5 %	1 %

The significant components of the Company's deferred tax assets and liabilities are as follows for the years ended September 30, 2023, and 2022:

	September 30,	
(in thousands)	**2023**	**2022**
Net operating loss carryforwards	$ 209,338	$ 191,337
Research and development credit carryforwards	49,454	35,109
Capitalized research and development	30,599	—
Operating lease liability	22,921	23,118
Stock-based compensation	13,858	13,138
Other	8,107	11,541
Gross deferred tax assets	$ 334,277	$ 274,243
Less: Valuation allowance	(302,381)	(240,660)
Net deferred tax assets	$ 31,896	$ 33,583
Fixed assets	$ (1,363)	$ (1,169)
Operating lease right-of-use asset	(17,417)	(17,986)
Intangible assets	(13,116)	(14,428)
Gross deferred tax liabilities	$ (31,896)	$ (33,583)
Total net deferred tax asset	$ —	$ —

Based on the available objective evidence, management believes it is more likely than not that the deferred tax assets will not be fully realizable. Accordingly, the Company has provided a full valuation allowance against its deferred tax assets at September 30, 2023 and 2022. The valuation allowance was $302.4 million and $240.7 million as of September 30, 2023 and 2022, respectively. The change in the valuation allowance was mainly due to an increase in the net operating loss, research and development credits and capitalized research and development during the fiscal year 2023.

The Company intends to continue maintaining a full valuation allowance on the Company's deferred tax assets until there is sufficient evidence to support the reversal of all or some portion of the allowance. The release of all, or a portion, of the valuation allowance would result in the recognition of certain deferred tax assets and a decrease to income tax expense for the period the release is recorded.

As of September 30, 2023, the Company had net operating loss carryforwards of approximately $842.3 million and $523.3 million available to reduce future taxable income, if any, for federal and state income tax purposes, respectively. Of the total federal net operating loss carryforwards, $641.3 million never expires and the remaining carryforwards of $201.0 million expire at various dates beginning in 2032 through 2038. Of the total state net operating loss carryforwards, the California State tax loss carryforwards of $255.9 million begin to expire in 2033 and the remaining carryforwards of $267.4 million for other states begin to expire at various dates beginning 2024 and beyond.

The Company also had federal and state research and development credit carryforwards of approximately $42.3 million and $28.8 million, respectively, at September 30, 2023. The federal credits will expire starting in 2033 if not utilized. The California research and development credits have no expiration date. Utilization of the net operating losses and tax credits is subject to annual limitation due to the ownership change limitations provided by the Internal Revenue Code and similar state provisions. Such annual limitations may result in the expiration of the net operating losses and tax credits before utilization.

The provisions of ASC 740-10, *Accounting for Uncertainty in Income Taxes*, prescribe a comprehensive model for the recognition, measurement, and presentation and disclosure in financial statements of any uncertain tax positions that have been taken or expected to be taken on a tax return. The Company has identified uncertain tax positions related to federal and state research and development credits and foreign jurisdictions.

The aggregate changes in the balance of gross unrecognized tax benefits are as follows:

(in thousands)	Federal and state
Balance as of September 30, 2020	$ 4,700
Increases related to tax positions taken during 2021	2,737
Balance as of September 30, 2021	$ 7,437
Increases related to tax positions taken during 2022	5,082
Increases related to tax positions taken in the prior year	864
Balance as of September 30, 2022	$ 13,383
Increases related to tax positions taken during 2023	$ 5,043
Increases related to tax positions taken in the prior year	759
Balance as of September 30, 2023	$ 19,185

The Company does not expect a material change in unrecognized tax benefits in the next twelve months. As of September 30, 2023 and 2022, approximately $0.4 million and $0.1 million of unrecognized tax benefit would, if recognized, impact the Company's effective income tax rate, respectively.

It is the Company's policy to include penalties and interest expense related to income taxes as a component of other expense and interest expense, respectively, as necessary. The Company's management determined that no accrual for interest and penalties was required as of September 30, 2023 and 2022.

The Company's files federal and state income tax returns with varying statutes of limitations. All tax years remain open to examination due to the carryover of net operating losses or tax credits. The Company currently has no federal or state tax examinations in progress.

9. Common stock

As of September 30, 2023, the Company had reserved sufficient shares of common stock with a par value of $0.00001 per share for issuance upon exercise of outstanding stock options. Each share of common stock is entitled to one vote. The holders of shares of common stock are also entitled to receive dividends whenever funds are legally available and when declared by the board of directors.

In February 2022, the Company completed an underwritten public offering of 5,227,272 shares of its common stock at a price to the public of $55.00 per share, including the full exercise of underwriters' option to purchase an additional 681,818 shares of common stock. The Company received total net proceeds from the offering of $269.8 million, net of underwriting discounts and commissions and offering expenses.

10. Stock-based compensation expense

2018 Equity Incentive Plan

On September 26, 2018, the board of directors adopted the 2018 Equity Incentive Plan (the 2018 Plan) as a successor to the 2013 Stock Plan (the 2013 Plan). The maximum aggregate number of shares that may be issued under the 2018 Plan is 6,856,405 of the Company's common stock. The number of shares reserved for issuance under the 2018 Plan will be increased automatically on the first day of each fiscal year, following the fiscal year in which the 2018 Plan became effective, by a number equal to the least of 999,900, 4% of the shares of common stock outstanding at that time, or such number of shares determined by the Company's board of directors. The common shares issuable under the 2018 Plan are registered pursuant to a registration statement on Form S-8 on November 1, 2018.

On August 22, 2023, the board of directors adopted an inducement equity incentive plan (the "Inducement Plan). The maximum aggregate number of shares that may be issued under the Inducement Plan is 700,000 of the Company's common stock. The Inducement Plan permits the grant of non-statutory stock options, restricted stock, restricted stock units, stock appreciation rights, performance units and performance shares. The shares issuable under the Inducement Plan are registered pursuant to a registration statement on Form S-8 filed with the Securities and Exchange Commission on August 25, 2023.

As of September 30, 2023, a total of 2,025,002 shares of the Company's common stock have been reserved for issuance under the 2018 Plan and the Inducement Plan.

Any shares subject to outstanding awards under the 2013 Plan that are canceled or repurchased subsequent to the 2018 Plan's effective date are returned to the pool of shares reserved for issuance under the 2018 Plan. Awards granted under the 2018 Plan may be non-statutory stock options, stock appreciation rights, restricted stock, restricted stock units, performance shares, and performance units.

Restricted Stock Units

Restricted stock consists of restricted stock unit awards (RSUs) which have been granted to employees and non-employee directors. The value of an RSU award is based on the Company's stock price on the date of grant. Employee grants generally vest over four years and non-employee director grants generally vest over one year. Forfeitures of RSUs are recognized as they occur. The shares underlying the RSU awards are not issued until the RSUs vest. Upon vesting, each RSU converts into one share of the Company's common stock.

Activity with respect to the Company's restricted stock units during the year ended September 30, 2023 is as follows:

(In thousands, except per share data)	Shares	Weighted average grant date fair value per share
Nonvested shares at September 30, 2022	1,566	$ 67.66
Granted	1,269	$ 25.36
Vested/Issued	(598)	55.29
Forfeited	(617)	63.40
Nonvested shares at September 30, 2023	1,620	$ 40.73

As of September 30, 2023, there was $60.4 million of total unrecognized compensation cost related to these issuances that is expected to be recognized over a weighted average period of 2.5 years. The total grant date fair value of RSUs awarded during the year ended September 30, 2023, and 2022 were $32.2 million and $96.2 million, respectively. The total grant date fair value of RSUs and performance stock units awarded during the year ended September 30, 2021 was $49.3 million. The total grant date fair value of RSUs vested during the year ended September 30, 2023 and 2022 were $33.7 million and $27.1 million, respectively. The total grant date fair value of RSUs and performance stock units vested during the year ended September 30, 2021 was $10.5 million.

Performance Stock Units

Performance stock unit awards ("PSUs") granted to certain employees will vest upon achievement of operational milestones related to the Wilsonville facility, and to Company executives will vest upon achievement of revenue, gross profit and cash balance metrics as determined by the board of directors, and to certain non-employee consultants will vest upon achievement of operational milestones. Stock compensation expense for PSUs is recorded over the vesting period based on the grant date fair value of the awards and probability of the achievement of specified performance targets. The grant date fair value is equal to the closing share price of the Company's common stock on the date of grant. For employees, PSUs generally vest over a one to three-year service period following the grant date, provided that the recipient is a Company employee at the time of vesting and the performance targets applicable to each award are achieved. For non-employees, PSUs generally vest over a one to three-year service period following the grant date, provided that the performance targets applicable to each award are achieved. The percentage of PSUs that vest will depend on the achievement of specified performance targets at the end of the performance period and can range from 0% to 150% of the number of units granted. Any PSU that are unvested at the end of the performance period are forfeited. Forfeitures of PSUs are recognized as they occur.

Activity under the PSUs during the year ended September 30, 2023 is summarized below:

(In thousands, except per share data)	Shares	Weighted average grant date fair value per share
Nonvested shares at September 30, 2022	529	$ 79.60
Granted	811	$ 26.17
Vested/Issued	(50)	35.47
Forfeited	(358)	76.04
Nonvested shares at September 30, 2023	932	$ 36.82

As of September 30, 2023, the unrecognized compensation costs related to these awards was $20.6 million, based on the maximum achievement of the performance targets. The Company expects to recognize those costs over a weighted average period of 1.5 years. The total grant date fair value of PSUs awarded during the year ended September 30, 2023 and 2022 were $21.2 million and $49.0 million, respectively. The total grant date fair value of PSUs vested during the year ended September 30, 2023 and 2022 were $1.8 million and $0.5 million, respectively.

Options

Options are generally granted to employees and were previously granted to non-employee directors. Stock options entitle the holder to purchase, at the end of the vesting term, a specified number of shares of Company common stock at an exercise price per share equal to the closing market price of the common stock on the date of grant. Stock options have a contractual life from the date of the grant and a vesting schedule as established by the board of directors. The maximum term of stock options granted under the 2018 Plan is 10 years and the awards generally vest over a four-year period. Forfeitures of options are recognized as they occur. The fair value of each services based stock option grant is estimated on the date of grant using the Black-Scholes option-pricing model. The Company historically had been a private company and lacked company-specific historical and implied volatility information for its stock. Therefore, it estimated its expected stock price volatility based on the historical volatility of publicly traded peer companies through the period ended September 30, 2023 and utilized the "simplified" method for awards that qualify as "plain-vanilla" options. As determined under the simplified method, the expected term of stock options granted is calculated based on contractual and vesting terms of the option award, the risk-free interest rate is determined by reference to the U.S. Treasury yield curve in effect at the time of grant of the award for time periods approximately equal to the expected term of the award and the expected dividend yield is zero based on the fact that the Company has never paid cash dividends on common stock and does not expect to pay any cash dividends in the foreseeable future.

Options activity during the year ended September 30, 2023 is summarized below:

(In thousands, except per share data)	Shares	Weighted average exercise price per share	Weighted average remaining contractual term (years)	Aggregate intrinsic value
Outstanding at September 30, 2022	2,453	$ 24.67	6.33	$ 33,447
Forfeited	(216)	36.47	—	—
Exercised	(118)	11.70	—	$ 1,091
Outstanding at September 30, 2023	2,119	$ 24.18	5.25	$ 6,715
Nonvested at September 30, 2023	77	$ 42.12	6.32	47
Exercisable at September 30, 2023	2,042	$ 23.51	5.21	$ 6,668

As of September 30, 2023, the unrecognized compensation costs related to these awards was $1.8 million. The Company expects to recognize those costs over a weighted average period of 0.8 years. The Company did not grant any options during the year ended September 30, 2023. The total grant date fair value of stock options awarded during the year ended September 30, 2022 was $15.8 million. The total grant date fair value of options and PSOs awarded during the year ended September 30, 2021 was $12.1 million. The aggregate intrinsic value of stock options exercised during the year ended September 30, 2022 was $31.9 million.

The fair value of options granted during the year ended September 30, 2022 were calculated using the weighted average assumptions set forth below:

	Year ended September 30,
	2022
Expected term (years)	6.0
Expected volatility	70.7 %
Risk-free interest rate	1.4 %
Dividend yield	—%

The fair value of options and performance stock options granted during the year ended September 30, 2021, were calculated using the weighted average assumptions set forth below:

	Year ended September 30, 2021
Expected term (years)	6.1
Expected volatility	64.4 %
Risk-free interest rate	1.0 %
Dividend yield	—%

Performance Stock Options

On September 1, 2020, the board of directors approved the implementation of a revised annual equity award program for executive officers, senior level employees and consultants to be granted as performance-based stock options ("PSOs") under the 2018 Plan. The number of PSOs ultimately earned under the awards to executive officers and senior level employees is calculated based on the achievement of a certain total revenue threshold during the fiscal year ended September 30, 2023. The percentage of performance stock options that vest will depend on the board of directors' determination of total revenue at the end of the performance period and can range from 0% to 150% of the number of options granted. The number of PSOs ultimately earned under the awards to a consultant is calculated based on the achievement of certain operational milestones. The maximum term of performance stock options granted under the 2018 Plan is 10 years for both employees and non-employees. The awards generally vest over a two-year period for executive officers and senior level employees. Awards to non-employees generally vest over a five-year period.

The provisions of the PSO are considered a performance condition, and the effects of that performance condition are not reflected in the grant date fair value of the awards. The Company used the Black-Scholes method to calculate the fair value at the grant date without regard to the vesting condition and will recognize compensation cost for the options that are expected to vest. Forfeitures of PSOs are recognized as they occur. The Company reassesses the probability of the performance condition at each reporting period and adjusts the compensation cost based on the probability assessment. As of September 30, 2023, the Company determined that 30,000 shares are expected to vest based on the probability of the performance condition that will be achieved under this equity award program.

Activity under the PSOs during the year ended September 30, 2023 is summarized below:

(In thousands, except per share data)	Shares	Weighted average exercise price per share	Weighted average remaining contractual term (years)	Aggregate intrinsic value
Outstanding at September 30, 2022	312	$ 61.35	8.33	$ 296
Exercisable at September 30, 2022	19	$ 31.29	9.57	$ 74
Nonvested at September 30, 2022	293	$ 63.27	8.25	$ 222
Forfeited	(23)	67.85	—	—
Vested	(240)	66.81	—	—
Nonvested at September 30, 2023	30	$ 31.29	8.57	$ —
Exercisable at September 30, 2023	259	$ 64.24	7.23	$ —
Outstanding at September 30, 2023	289	$ 60.82	7.37	$ —

As of September 30, 2023, the unrecognized compensation costs related to these awards was $0.3 million. The Company expects to recognize those costs over a weighted average period of 1.6 years. The Company did not grant any PSOs during the year ended September 30, 2023. The total grant date fair value of performance stock options awarded during the year ended September 30, 2022 was $1.5 million.

The fair values of PSOs granted during the year ended September 30, 2022 were calculated using the weighted average assumptions set forth below:

	Year ended September 30,
	2022
Expected term (years)	5.9
Expected volatility	70.9%
Risk-free interest rate	2.8%
Dividend yield	—%

Stock-based compensation

Total stock-based compensation expense recognized were as follows:

	Year ended September 30,		
(in thousands)	2023	2022	2021
Cost of revenues	$ 4,562	$ 4,587	$ 2,678
Research and development	13,944	19,541	10,166
Selling, general and administrative	11,772	54,905	24,154
Total stock-based compensation	$ 30,278	$ 79,033	$ 36,998

An immaterial amount of stock-based compensation was capitalized to inventories attributable to employees who support the manufacturing of the Company's products for the year ended September 30, 2023. The balance sheet as of September 30, 2023 and 2022 includes $1.2 million and $0.7 million, respectively, of stock-based compensation primarily related to implementation of the Company's lab production software system and order management system, which was capitalized in property and equipment.

The total amount of share-based liabilities settled were $5.9 million and $4.6 million for the year ended September 30, 2023 and 2022, respectively. The settlement of the liabilities related to the issuance of contingent consideration and indemnity holdbacks associated with Abveris and iGenomX acquisition.

2018 Employee Stock Purchase Plan

On September 26, 2018, the board of directors adopted the 2018 Employee Stock Purchase Plan (the 2018 ESPP). A total of 275,225 shares of the Company's common stock have been reserved for issuance under the 2018 ESPP. The number of shares reserved for issuance under the 2018 ESPP will be increased automatically on the first day of each fiscal year, following the fiscal year in which the 2018 ESPP becomes effective, by a number equal to the least of 249,470 shares, 1% of the shares of common stock outstanding at that time, or such number of shares determined by the Company's board of directors. The number of shares reserved for issuance as at September 30, 2023 is as follows:

(In thousands)	Shares available
Outstanding at September 30, 2022	507
Additional shares authorized	249
Shares issued during the period	(217)
Outstanding at September 30, 2023	539

Subject to any plan limitations, the 2018 ESPP allows eligible service providers (through qualified and non-qualified offerings) to contribute, normally through payroll deductions, up to 15% of their earnings for the purchase of the Company's common stock at a discounted price per share. The offering periods are beginning in February and August of each year, except the initial offering period which commenced with the initial public offering in October 2018 and ended on August 20, 2019. The common shares issuable under the 2018 ESPP were registered pursuant to a registration statement on Form S-8 on November 26, 2018.

Unless otherwise determined by the board of directors, the Company's common stock will be purchased for the accounts of employees participating in the 2018 ESPP at a price per share that is the lesser of 85% of the fair market value of the Company's common stock on the first trading day of the offering period, which for the initial offering period is the price at

which shares of the Company's common stock were first sold to the public, or 85% of the fair market value of the Company's common stock on the last trading day of the offering period. During the years ended September 30, 2023, 2022 and 2021 activity under the 2018 ESPP was immaterial.

401(k) Savings Plan

During 2018, the Company adopted a 401(k) savings plan for the benefit of its employees. In January 2022, the Company modified its plan to include an employer matching contribution. The Company is required to make matching contributions to the 401(k) plan equal to 50% of the first 6% of wages deferred by each participating employee. For the year ended September 30, 2023 and 2022, the Company incurred expenses for employer matching contributions of $2.8 million and $2.0 million, respectively.

Abveris Acquisition

As discussed further in Note 13 "Business acquisition", on December 1, 2021, the Company completed the acquisition of AbX Biologics, Inc., a privately-held company providing in vivo antibody discovery services ("Abveris") and granted certain equity awards to new employees. These equity awards included up to 231,876 restricted shares of the Company's common stock which are issuable based on achievement of the 2022 calendar revenue target, which had an aggregate grant date fair value of $20.1 million. In addition, all employees must remain employed through the payout date, and certain employees have an additional vesting period of up to two years from the acquisition date. The vesting upon achievement of the 2022 calendar revenue target is considered a performance condition, and the effects of that performance condition are not reflected in the grant date fair value of the awards. The Company used the stock price as of December 1, 2021 for the fair value of restricted shares.

At September 30, 2022, management determined that the performance condition relating to these awards was probable of being achieved, and cumulative stock-based compensation expense of $9.9 million was recognized during the year ended September 30, 2022. At December 31, 2022, management determined that the performance condition was not achieved, and therefore the cumulative stock-based compensation expense recognized to date was reversed, resulting in a reduction of stock compensation expense of $9.9 million in the three months ended December 31, 2022.

11. Net loss per share attributable to common stockholders

The following table sets forth the computation of the Company's basic and diluted net loss per share attributable to common stockholders:

	Year ended September 30,		
(in thousands, except per share data)	**2023**	**2022**	**2021**
Numerator:			
Net loss attributable to common stockholders	$ (204,618)	$ (217,863)	$ (152,098)
Denominator:			
Weighted-average shares used in computing net loss per share, basic and diluted	56,885	53,885	48,251
Net loss per share attributable to common stockholders, basic and diluted	$ (3.60)	$ (4.04)	$ (3.15)

The potentially dilutive common shares that were excluded from the calculation of diluted net loss per share because their effect would have been antidilutive for the periods presented are as follows:

	Year ended September 30,		
(in thousands)	**2023**	**2022**	**2021**
Shares subject to options to purchase common stock	2,408	2,765	3,131
Unvested restricted stock units and performance stock units	2,552	2095	707
Unvested shares of common stock issued upon early exercise of stock options	—	—	3
Shares subject to employee stock purchase plan	118	97	27
Total	5,078	4,957	3,868

12. Geographic, product and industry information

The table below sets forth revenues by geographic region, based on ship-to destinations. Americas consists of the United States, Canada, Mexico and South America; EMEA consists of Europe, the Middle East, and Africa; and APAC consists of Japan, China, South Korea, India, Singapore, Malaysia and Australia.

	Year ended September 30,		
(in thousands)	2023	2022	2021
Americas	$ 151,263	$ 122,473	$ 77,909
EMEA	71,389	62,078	44,124
APAC	22,457	19,014	10,300
Total	$ 245,109	$ 203,565	$ 132,333

The table below sets forth revenues by products.

	Year ended September 30,		
(in thousands)	2023	2022	2021
Synthetic genes	$ 73,541	$ 61,509	$ 38,964
Oligo pools	14,489	12,424	8,039
DNA libraries	10,201	6,149	5,678
Antibody discovery	23,172	24,171	6,985
NGS tools	123,706	99,312	72,667
Total	$ 245,109	$ 203,565	$ 132,333

The table below sets forth revenues by industry.

	Year ended September 30,		
(in thousands)	2023	2022	2021
Industrial chemicals/materials	$ 59,321	$ 57,940	$ 34,475
Academic research	45,847	37,097	25,299
Healthcare	137,148	106,363	71,241
Food/agriculture	2,793	2,165	1,318
Total revenues	$ 245,109	$ 203,565	$ 132,333

Revenue from the United States represented 60%, 59% and 58% of the total revenue for the years ended September 30, 2023, 2022 and 2021, respectively. Long-lived assets located in the United States were $131.2 million and $136.3 million as of September 30, 2023 and 2022, respectively. Long-lived assets located outside of the United States were $0.6 million and $3.1 million as of September 30, 2023 and 2022, respectively.

13. Business acquisition

AbX Biologics, Inc. ("Abveris")

On December 1, 2021, the Company acquired all of the outstanding stock of Abveris. The acquisition date fair value of the consideration transferred for Abveris was $102.6 million, consisting of cash totaling $9.5 million, 759,601 shares of the Company's common stock valued at $66.1 million based on the Company's closing stock price on December 1, 2021, employee stock awards issued to certain Abveris employees valued at $6.4 million, contingent consideration of $8.5 million, holdbacks of $12.8 million, and a net estimated working capital adjustment of $0.7 million.

The contingent consideration was subject to the attainment of the calendar year 2022 revenue target. The contingent consideration was payable after December 31, 2022 in a combination of cash and up to 334,939 shares of the Company's common stock. The acquisition date fair value of the contingent consideration was based on forecasted revenue of Abveris relative to the 2022 revenue target as well as the Company's stock price as of December 1, 2021.

The Company maintained an indemnity and adjustment holdback for the purposes of providing security against any adjustment to the amounts at closing. The indemnity holdback period extends for 18 months from the anniversary of the closing date. The indemnity holdback was settled by transferring 104,727 shares of the Company's stock and an immaterial amount of cash. The fair value of the indemnity holdback was $12.5 million as of the acquisition date. The adjustment holdback represented up to 3,416 shares of the Company's stock, options to purchase up to 408 shares of the Company's common stock and an immaterial amount of cash. The holdback adjustment liability was $0.3 million as of the acquisition date. The adjustment holdback liability was settled during fiscal 2023 by transferring 538 shares.

As of the acquisition date, post-combination compensation expense excluded from the purchase price included employee stock awards issued to certain Abveris employees valued at $41.0 million. This included awards valued at $17.7 million which vest over a two year service period following the acquisition date and awards valued at $3.2 million with no future vesting requirements, which were deemed accelerated by the Company at the acquisition date and expensed within the three months ended December 31, 2021. Finally, post-combination expense included awards valued at approximately $20.1 million which vest based on achievement of the calendar year 2022 revenue target and continuing employment through the payout date, and for certain employees, additional continuing employment through the two year anniversary of the acquisition date. At the conclusion of the measurement period ended December 31, 2022, management determined that the revenue target associated with the performance based awards was not met, and therefore none of these awards vested.

The following table summarizes the final fair value amounts of the assets acquired and liabilities assumed as of the acquisition date, as well as the purchase consideration:

(in thousands)	December 1, 2021
Assets acquired	
Cash and cash equivalents	$ 1,306
Accounts receivable	2,309
Other current assets and prepaid expenses	1,654
Property, plant and equipment	1,078
Other non-current assets	2,970
Intangible assets	46,500
Liabilities assumed	
Current liabilities	3,549
Non-current liabilities	846
Deferred tax liability	10,545
Fair value of assets acquired and liabilities assumed	$ 40,877
Goodwill	61,768
Total purchase price	$ 102,645
Consideration transferred	
Cash	$ 9,467
Company common stock	72,514
Contingent consideration	8,500
Holdback liabilities	12,838
Net working capital adjustment	(674)
Fair value of purchase consideration	$ 102,645

The following table summarizes the estimate of the intangible assets as of the acquisition date:

(in thousands except for years)	Estimated Weighted Average Useful Lives in Years	Estimated Fair Value
Developed technology	14	$ 30,900
Customer relationships	10	14,700
Trade name	3	900
Estimated fair value of acquired intangible assets		$ 46,500

The Company estimated the fair value of the developed technology intangible asset and a portion of the customer relationships intangible assets using an excess earnings model. An additional portion of the customer relationships intangible assets was valued using the with and without method. The Company estimated the fair value of the trade name intangible asset using a relief from royalty approach. These fair value measurements were based on significant inputs not observable in the market and thus represent a Level 3 measurement. Key assumptions include the level and timing of expected future revenue, conditions and demands specific to each intangible asset over its remaining useful life, and discount rates the Company believes to be consistent with the inherent risks associated with each type of asset, which was approximately 9.6%. The fair value of these intangible assets is primarily affected by the projected revenues, gross margins, operating expenses, the technology obsolescence curve, and the anticipated timing of the projected income associated with each intangible asset coupled with the discount rates used to derive their estimated present values. The Company believes the level and timing of expected future cash flows appropriately reflects market participant assumptions.

The following table provides a reconciliation of contingent consideration and holdbacks balances from acquisition date to September 30, 2023:

(in thousands)	Contingent consideration	Holdbacks	Total
Balance at December 1, 2021 – acquisition date	$ 8,500	$ 12,164	$ 20,664
Change in fair value during the period	(6,400)	(7,071)	(13,471)
Balance at September 30, 2022	$ 2,100	$ 5,093	$ 7,193
Change in fair value during the period	$ (2,100)	$ (3,326)	$ (5,426)
Settlement during the period	—	(1,767)	(1,767)
Balance at September 30, 2023	$ —	$ —	$ —

The estimated fair value of the contingent consideration liability decreased as a result of the change in the Company's stock price from December 1, 2021 to June 30, 2023. The estimated fair value of the holdback liability decreased as a result of the change in the Company's stock price as of June 30, 2023. In June 30, 2023, the indemnity holdback period ended, and the Company issued 104,727 shares of its common stock to satisfy the indemnity holdback. The shares of common stock, valued at $1.8 million, were issued by the Company during three months ended June 30, 2023 along with an immaterial cash payment for fractional shares.

The post-combination effect from net deferred tax liability assumed from the Abveris acquisition also caused a release of the Company's deferred income tax valuation allowance. On the acquisition date, the release resulted in an income tax benefit of $10.5 million.

Issuance of contingent consideration for iGenomX acquisition

In December 2022, the indemnity holdback period ended, and the Company became obligated to issue 171,551 shares of its common stock to satisfy the indemnity holdback. The shares of common stock, valued at $4.1 million, were subsequently issued by the Company during January 2023 along with an immaterial cash payment for fractional shares.

In December 2021, the Company determined that the transition milestones specified in the iGenomX acquisition agreement were completed, and the Company became obligated to issue 59,190 shares of its common stock to satisfy the contingent consideration. The shares of common stock, valued at $4.6 million, were subsequently issued by the Company during January 2022 along with an immaterial cash payment for fractional shares.

14. 2023 Restructuring and other costs

On May 3, 2023, the Company's Board of Directors approved a strategic restructuring plan to reduce costs, build a leaner organization and increase operating efficiencies. The restructuring plan included a reduction in force which affected approximately 270 employees worldwide, representing approximately 25% of the Company's total workforce. The majority of these employees separated from the Company by September 30, 2023. The reduction in force is subject to local regulatory requirements. Furthermore, as part of the plan the Company removed the duplication of synthetic biology production across its South San Francisco, California and Wilsonville, Oregon facilities. The plan was implemented beginning in May 2023 and was substantially completed by the end of fiscal year 2023.

The Company recognized cumulative pre-tax restructuring $12.7 million and other costs of approximately $3.5 million in the fiscal year ended September 30, 2023, consisting of costs associated with employee severance and related benefits, asset impairments and other associated costs. The Company expects to incur immaterial employee severance and benefits expenses for costs to be recognized over the remaining service period of impacted employees.

All charges related to the restructuring plan have been recorded to Restructuring and other costs in the consolidated statements of operations and comprehensive loss.

Restructuring and other costs are presented in the table below:

	Year ended September 30,
(in thousands)	**2023**
Severance and related benefit costs	$ 8,467
Asset impairments [(1)]	6,785
Other associated costs [(2)]	917
	$ 16,169

[(1)] Related to write-off of lab equipment ($3.7 million) and leasehold improvements for decommissioned labs ($1.8 million) and computer software ($1.3 million).
[(2)] Related primarily to costs associated with transferring assets between labs and professional service assistance related to the restructuring.

The following table shows the accrual activity and payments relating to cash-based restructuring costs:

(in thousands)	**Severance and related benefit costs**	**Other associated costs**	**Total**
Costs	$ 8,467	$ 917	$ 9,384
Payments	$ (7,950)	$ (917)	$ (8,867)
Balance as of September 30, 2023	$ 517	$ —	$ 517

As of September 30, 2023, $0.5 million of severance and related benefit costs is included in accrued compensation in the consolidated balance sheets. We expect that substantially all of the remaining accrued restructuring liabilities will be paid in cash over next four months.

15. Investment in variable interest entity

On November 1, 2021, the Company contributed certain assets and licensed certain intellectual property rights to the then newly formed Revelar Biotherapeutics, Inc. ("Revelar"), an independently operated, new biotechnology company, to develop and commercialize an antibody, discovered and optimized by Twist Biopharma, a division of the Company. The Company granted a license to Revelar for the exclusive development of an antibody lead along with a series of back up compounds for the potential treatment of SARS-CoV-2. While the licensed antibody neutralized all known variants of concern through Omicron, it does not neutralize the BA.4 and BA.5 variants. The Company committed to invest up to $10.0 million in seed funding based on Revelar's progress in the development of the lead antibody and the potential licensing of additional antibody therapeutics, of which the Company made an initial investment of $5.0 million in a simple agreement for future equity ("SAFE"), and two additional investments of $2.5 million each, as described below. In exchange for the assignment of certain contractual rights and the license to the antibody, and its back-up compounds, the Company received stock of Revelar amounting to an ownership percentage as of the date of these financial statements of

49.8%, excluding shares and options reserved for future stock awards and further excluding shares that Revelar would have issued to the Company upon conversion of its SAFEs.

On February 3, 2022, the Company purchased an additional SAFE issued by Revelar for $2.5 million pursuant to the Asset License and Contract Assignment Agreement between the parties. In exchange for the SAFE, the Company obtained the right to receive shares of Revelar issued in a future preferred stock financing.

On April 6, 2022, the Company purchased an additional SAFE issued by Revelar for $2.5 million pursuant to the Asset License and Contract Assignment Agreement between the parties. In exchange for the SAFE, the Company obtained the right to receive shares of Revelar issued in a future preferred stock financing.

The Company determined that Revelar was a VIE as the entity lacks sufficient equity to finance its activities without additional support. Additionally, the Company determined that it has (a) the power to direct the activities that significantly impact Revelar’s economic performance and (b) the obligation to absorb losses of, and the right to receive benefits from, Revelar that are potentially significant to Revelar. As a result, the Company was deemed to be the primary beneficiary of Revelar and is required to consolidate Revelar in accordance with ASC 810; however, the Company deconsolidated Revelar as described below.

Revelar incurred a net loss of approximately $14.6 million for the year ended September 30, 2022, and the decrease in net assets was fully absorbed by the Company.

The license agreement with Revelar which provided the Company with power to direct Revelar's activities that most significantly affected Revelar's economic performance and caused the Company to have the obligation to absorb or right to receive the majority of Revelar's losses or benefits, was terminated by all parties on September 30, 2022. As a result, the Company assessed its status as the primary beneficiary of Revelar and determined it was no longer the primary beneficiary of the VIE. The Company deconsolidated Revelar as of September 30, 2022. The deconsolidation resulted in a gain of $4.6 million, recorded in “gain on deconsolidation of subsidiary” in the consolidated statements of comprehensive loss in the year ended September 30, 2022 and the Company deconsolidated Revelar's net liabilities of $4.6 million.

16. Subsequent Events

On October 5, 2023, the Company entered into antibody discovery and licensing option agreement with Bayer AG ("Bayer"). Under the terms of the agreement, the Company will conduct antibody discovery campaigns against targets to be determined by Bayer. Bayer will have the option to license antibodies discovered under the collaboration. Under the terms of the agreement, the Company will receive payments connected with the initiation of research and will be eligible to receive fees associated with research milestones and the exercise of licensing options. The antibody leads discovered under the collaboration that enter clinical development qualify for certain success-based clinical and commercial milestone payments as well as royalties from product sales. In total, the Company is eligible to receive up to $188.0 million in clinical and commercial milestone payments plus royalties. In return, Bayer receives exclusive rights to license the antibodies for commercialization in all global territories.

* * * * *

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

Under the supervision and with the participation of our management, including our Chief Executive Officer and Chief Financial Officer, we evaluated the effectiveness of our disclosure controls and procedures (as that term is defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934, as amended (the "Exchange Act")) as of September 30, 2023, which is the end of the period covered by this Annual Report. Based on this evaluation, our Chief Executive Officer and Chief Financial Officer concluded that the Company's disclosure controls and procedures were not effective as of September 30, 2023 as a result of material weakness in our internal control over financial reporting as described below.

In light of the material weakness in the Company's internal control over financial reporting, we performed additional procedures to ensure that our consolidated financial statements included in Form 10-K were prepared in accordance with accounting principles generally accepted in the United States ("GAAP"). Following such additional procedures, our management, including our principal executive officer and principal financial officer, has concluded that our consolidated financial statements present fairly, in all material respects, our financial position, results of operations and cash flows for the periods presented in this Form 10-K, in conformity with GAAP**.**

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 Exchange Act Rules 13a-15(f) and 15d-15(f). Our internal control over financial reporting is a framework designed under the supervision and with the participation of our management, including our Chief Executive Officer and Chief Financial Officer, and effected by our board of directors, management, and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of our financial statements for external purposes in accordance with US GAAP.

As of September 30, 2023, our management conducted an evaluation of the effectiveness of our internal control over financial reporting based on the criteria for effective internal control over financial reporting established by the Committee of Sponsoring Organization of the Treadway Commission (COSO) in Internal Control – Integrated Framework (2013). Based on this evaluation, due to the material weakness described below, we concluded that the system of internal control over financial reporting was not effective.

The material weakness in our internal control over financial reporting which existed as of September 30, 2023 related to ineffective design and implementation of information technology general controls ("ITGCs") in the areas of user access and program change management that are relevant to the preparation of our financial statements.

Notwithstanding the material weakness, we have concluded that the financial statements and other financial information included in this Annual Report fairly present in all material respects our financial condition, results of operations and cash flows for the periods presented in conformity with accounting principles generally accepted in the United States.

The effectiveness of our internal control over financial reporting as of September 30, 2023 has been audited by Ernst & Young LLP, an independent registered public accounting firm, as stated in their report included in Part II, Item 8 of this Annual Report on Form 10-K.

Remediation of Prior Year Material Weakness

As disclosed in Part II, Item 9A of our Annual Report on Form 10-K for fiscal 2022, we previously identified a material weakness related to ineffective design and implementation of ITGC in the areas of user access and program change management that are relevant to the preparation of our financial statements. Primarily, we did not design and maintain user access controls to ensure appropriate segregation of duties that adequately restrict user access to certain financial applications and data to appropriate Company personnel. As a result, the Company's related process-level IT-dependent manual and automated controls that rely upon the affected ITGCs, or information from IT systems with affected ITGCs, were also deemed ineffective in fiscal 2022.

During fiscal 2023, we implemented an intensive program to remediate the previously identified material weakness, which included expanding resources, enhancing our control activities for key systems, and providing training. While we believe

that we have completed updates to the control design for the majority of our systems in response to the identified material weakness, the re-designed controls did not operate for a sufficient period of time for management to conclude on operating effectiveness of the controls that were redesigned in fiscal 2023.

We concluded this material weakness did not result in any material misstatement in our financial statements or disclosures for the fiscal year ended September 30, 2023.

Our management is committed to maintaining a strong internal control environment. In response to the material weakness above, management is continuing to take actions to remediate the material weakness in internal control over financial reporting, which include but are not limited to the following:

- Complete implementation of role redesign for certain systems, which includes rationalization of user roles and permissions and considers segregation of duties.
- Continue to implement improved IT policies and perform training to ensure a clear understanding of risk assessment, control execution, and monitoring activities related to financial reporting.
- Continue to expand the available resources at the Company with experience designing and implementing control activities, including ITGCs, through hiring and use of third-party consultants and specialists.
- Continue to address known issues identified within change management and enforce consistent execution of key control procedures.

With these actions, when fully implemented and operated consistently, we believe we will remediate the material weakness. The material weakness will not be considered remediated until the applicable controls operate for a sufficient period of time and management has concluded, through testing, that these controls are operating effectively. As we continue to ensure alignment with the Company's business strategy and operations for the applicable controls, we may determine additional remediation measures are required.

Changes in Internal Control Over Financial Reporting

Except as noted in the preceding paragraphs, there were no changes during the quarter ended September 30, 2023 in our internal control over financial reporting that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting. Our plans for remediating the material weakness, enumerated above, will constitute changes in our internal control over financial reporting, when such remediation plans are effectively implemented.

Limitations on Effectiveness of Controls and Procedures

Our disclosure controls and procedures are designed to provide reasonable assurance of achieving their objectives, as specified above. Our management recognizes that any control system, no matter how well designed and operated, is based upon certain judgments and assumptions and cannot provide absolute assurance that its objectives will be met.

Report of Independent Registered Public Accounting Firm

To the Stockholders and the Board of Directors of Twist Bioscience Corporation

Opinion on Internal Control Over Financial Reporting

We have audited Twist Bioscience Corporation's internal control over financial reporting as of September 30, 2023, based on criteria established in Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) (the COSO criteria). In our opinion, because of the effect of the material weakness described below on the achievement of the objectives of the control criteria, Twist Bioscience Corporation (the Company) has not maintained effective internal control over financial reporting as of September 30, 2023, based on the COSO criteria.

A material weakness is a deficiency, or combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis. The following material weakness has been identified and included in management's assessment. Management has identified a material weakness in controls related to the ineffective design and implementation of information technology general controls ("ITGCs") in the areas of user access and program change-management for systems that support the Company's financial reporting processes, which also resulted in the conclusion that related process-level IT-dependent manual and automated controls that rely upon the affected ITGCs, or information from IT systems with affected ITGCs, were also deemed ineffective.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated balance sheets of the Company as of September 30, 2023 and 2022, the related consolidated statements of operations and comprehensive loss, stockholders' equity and cash flows for each of the two years in the period ended September 30, 2023, and the related notes (collectively referred to as the "consolidated financial statements"). This material weakness was considered in determining the nature, timing and extent of audit tests applied in our audit of the 2023 consolidated financial statements, and this report does not affect our report dated November 21, 2023, which expressed an unqualified opinion thereon.

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/ Ernst & Young LLP

San Mateo, California
November 21, 2023

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

Rule 10b5-1 Trading Plans

On September 12, 2023, Emily M. Leproust, the Company's Chief Executive Officer, adopted a trading plan intended to satisfy the affirmative defense conditions of Rule 10b5-1(c) under the Exchange Act (a "10b5-1 Plan"). Ms. Leproust's 10b5-1 Plan provides for the potential sale of up to 369,600 shares of the Company's common stock and will expire on the earlier of December 16, 2024 and the date when all shares under the 10b5-1 Plan are sold.

Item 9C. ***Disclosure Regarding Foreign Jurisdiction That Prevent Inspections***

Not applicable.

PART III

Item 10. ***Directors, executive officers and corporate governance***

Incorporated by reference from our Definitive Proxy Statement to be filed in connection with the 2024 Annual Meeting of Stockholders.

Code of Ethics

We have adopted the Twist Bioscience Corporation Code of Business Conduct and Ethics, or Code of Ethics, with which every person, including executive officers, who works for Twist and every member of our board of directors is expected to comply. The full text of our Code of Ethics is posted on the investor relations section of our website at www.twistbioscience.com. If any substantive amendments are made to the Code of Ethics or any waiver is granted, we intend to satisfy the disclosure requirement under Item 5.05 of Form 8-K regarding such amendment to, or waiver from, a provision of this Code of Ethics by posting such information on our website, at the address and location specified above, or as otherwise required by the Nasdaq Global Select Market.

Item 11. ***Executive compensation***

Incorporated by reference from our Definitive Proxy Statement to be filed in connection with the 2024 Annual Meeting of Stockholders.

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

Incorporated by reference from our Definitive Proxy Statement to be filed in connection with the 2024 Annual Meeting of Stockholders.

Item 13. ***Certain relationships and related transactions, and director independence***

Incorporated by reference from our Definitive Proxy Statement to be filed in connection with the 2024 Annual Meeting of Stockholders.

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

Incorporated by reference from our Definitive Proxy Statement to be filed in connection with the 2024 Annual Meeting of Stockholders.

PART IV

Item 15. *Exhibits, financial statement schedules*

Documents filed as part of this report are as follows:

(a) Consolidated Financial Statements

Our Consolidated Financial Statements are included in the "Index to Consolidated Financial Statements" under Part II, Item 8 and filed as part of this Annual Report on Form 10-K.

(b) Consolidated Financial Statement Schedules

All financial statement schedules are omitted because the information called for is not required or is shown either in the consolidated financial statements or in the notes thereto.

(c) Exhibits

Set forth below is a list of exhibits that are being filed or incorporated by reference into this Annual Report on Form 10-K:

Exhibit Number	Description	Filed / Furnished / Incorporated by Reference from Form	Incorporated by Reference from Exhibit Number	Date Filed
3.1	Amended and Restated Certificate of Incorporation	8-K	3.1	11/7/2018
3.2	Amended and Restated Bylaws	8-K	3.1	11/18/2022
4.1	Form of common stock certificate	S-1/A	4.1	10/17/2018
4.3	Warrant to Purchase Stock by and between Twist Bioscience Corporation and Silicon Valley Bank, dated March 28, 2016.	S-1	4.7	10/3/2018
4.4	Description of Common Stock	10-K	4.5	11/20/2020
+10.1	2013 Stock Plan and forms of agreement thereunder	S-1	10.1	10/3/2018
+10.2	2018 Equity Incentive Plan and forms of agreement thereunder	S-1/A	10.2	10/17/2018
+10.3	2018 Employee Stock Purchase Plan	S-1/A	10.3	10/17/2018
+10.4	Executive Incentive Bonus Plan	S-1	10.4	10/3/2018
+10.5	Form of Indemnification Agreement between Twist Bioscience Corporation and each of its Officers and Directors	S-1/A	10.8	10/17/2018
10.6	Fourth Amended and Restated Loan and Security Agreement by and between Twist Bioscience Corporation, Silicon Valley Bank and certain other co-borrowers, dated September 6. 2017	S-1	10.9	10/3/2018

Exhibit Number	Description	Filed / Furnished / Incorporated by Reference from Form	Incorporated by Reference from Exhibit Number	Date Filed
10.7	Lease Agreement by and between Twist Bioscience Corporation and ARE-San Francisco No. 32. LLC dated March 21, 2018	S-1	10.11	10/3/2018
10.7.1	First Amendment to Lease by and between Twist Bioscience Corporation and ARE-San Francisco No. 32, LLC, dated March 21, 2019	10-Q	10.2	5/1/2019
10.8*	Lease Agreement by and between Twist Bioscience Corporation and PWII Owner, LLC, dated December 18, 2020	8-K	10.1	12/22/2020
10.8.1*	First Amendment to Lease between Twist Bioscience Corporation and PWII Owner, LLC, dated April 13, 2021	8-K	10.1	4/16/2021
10.9†	End User Supply Agreement by and between Twist Bioscience Corporation and FUJIFILM Dimatix, Inc., dated November 5, 2015	S-1	10.14	10/3/2018
10.10	Amended and Restated Employment Agreement dated October 26, 2022 between Twist Bioscience Corporation and Patrick Finn.	10-Q	10.1	2/7/2023
10.11	Twist Bioscience Corporation Inducement Equity Incentive Plan and related forms of award agreements thereunder.	S-8	99.1	8/25/2023
16.1	Letter from PricewaterhouseCoopers LLP addressed to the Securities Exchange Commission, dated March 9, 2022	8-K	16.1	3/9/2022
21.1	List of subsidiaries of the Registrant	Filed herewith		
23.1	Consent of Ernst & Young, Independent Registered Public Accounting Firm	Filed herewith		
23.2	Consent of PricewaterhouseCoopers, Independent Registered Public Accounting Firm	Filed herewith		
31.1	Certification pursuant to Section 302 of the Sarbanes-Oxley Act of 2002, Rule 13(a)-14(a)/15d-14(a), by President and Chief Executive Officer	Filed herewith		
31.2	Certification pursuant to Section 302 of the Sarbanes-Oxley Act of 2002, Rule 13(a)-14(a)/15d-14(a), by Chief Financial Officer	Filed herewith		

Exhibit Number	Description	Filed / Furnished / Incorporated by Reference from Form	Incorporated by Reference from Exhibit Number	Date Filed
32.1	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, by President and Chief Executive Officer	Furnished herewith		
32.2	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, by Chief Financial Officer	Furnished herewith		
101.INS	XBRL Instance Document	Filed herewith		
101.SCH	XBRL Taxonomy Extension Schema Document	Filed herewith		
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document	Filed herewith		
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document	Filed herewith		
101.LAB	XBRL Taxonomy Extension Label Linkbase Document	Filed herewith		
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document	Filed herewith		
104	Cover page from the Company's Annual Report on Form 10-K for the year ended September 30, 2023, formatted in Inline XBRL			

+ Indicates a management contract or compensatory plan.

* Registrant has omitted schedules and exhibits pursuant to Item 601(a)(5) of Regulation S-K. Registrant agrees to furnish supplementally a copy of the omitted schedules and exhibits to the SEC upon request.

† Portions of this exhibit (indicated by asterisks) have been omitted pursuant to a request for confidential treatment that was separately filed with the SEC.

Item 16. ***Form of 10-K summary***

Not applicable

SIGNATURES

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

November 21, 2023 Twist Bioscience Corporation

By: /s/ Emily M. Leproust
Emily M. Leproust
Chief Executive Officer

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

Signature	Title	Date
/s/ Emily M. Leproust Emily M. Leproust	Chief Executive Officer and Chair of the Board of Directors (principal executive officer)	November 21, 2023
/s/ James M. Thorburn James M. Thorburn	Chief Financial Officer (principal financial officer)	November 21, 2023
/s/ Robert F. Werner Robert F. Werner	Chief Accounting Officer (principal accounting officer)	November 21, 2023
/s/ William Banyai William Banyai	Director	November 21, 2023
/s/ Nelson C. Chan Nelson C. Chan	Director	November 21, 2023
/s/ Robert Chess Robert Chess	Director	November 21, 2023
/s/ Keith Crandell Keith Crandell	Director	November 21, 2023
/s/ Jan Johannessen Jan Johannessen	Director	November 21, 2023
/s/ Xiaoying Mai Xiaoying Mai	Director	November 21, 2023
/s/ Robert Ragusa Robert Ragusa	Director	November 21, 2023
/s/ Melissa Starovasnik Melissa Starovasnik	Director	November 21, 2023

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SOUTH SAN FRANCISCO, CA 94080
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Executive Officers

Emily M. Leproust, Ph.D.
Chief Executive Officer

Patrick Finn, Ph.D.
President and Chief Operating Officer

James M. Thorburn
Chief Financial Officer

William Banyai, Ph.D.
Senior Vice President of Advanced Development, General Manager of Data Storage

Dennis Cho
Senior Vice President, General Counsel, Secretary and Chief Ethics and Compliance Officer

Paula Green
Senior Vice President of Human Resources

Robert Werner
Chief Accounting Officer

Board of Directors

Emily M. Leproust, Ph.D.
Chief Executive Officer

William Banyai, Ph.D.
Senior Vice President of Advanced Development, General Manager of Data Storage

Nelson C. Chan
Member of the Audit and Risk Committee and Nominating and Corporate Governance Committee; Lead Director for ESG

Robert Chess
Lead Independent Director; Chair of the Nominating and Corporate Governance Committee; Member of the Compensation Committee

Keith Crandell
Managing Director at ARCH Venture Management, L.P.; Member of the Compensation Committee and Nominating and Corporate Governance Committee

Jan Johannessen
Advisor at iGlobe Partners; Chair of the Audit and Risk Committee; Member of the Nominating and Corporate Governance Committee

Xiaoying Mai
Executive Director at GF Investments (Hong Kong); Member of the Audit and Risk Committee

Robert Ragusa
Chief Executive Officer at GRAIL, LLC; Member of the Audit and Risk Committee and Compensation Committee

Melissa Starovasnik, Ph.D.
Chair of the Compensation Committee