
PacBio
2022 ANNUAL REPORT

Fellow Stockholders,

When I joined PacBio in late 2020, I worked with our team to develop a new strategic plan to drive our growth. The first phase of that plan, setting the foundation, is primarily comprised of three components: expanding our commercial footprint to increase Sequel IIe placements, innovating to create higher throughput sequencing platforms, and collaborating to demonstrate the power of HiFi, our long-read sequencing technology.

I'm pleased to report that despite an extremely challenging macroeconomic environment, we have made significant progress on all three strategic core pillars.

Before we review some of the accomplishments in 2022, I want to recognize the nearly 800 employees of PacBio whose efforts are pushing us toward our mission of enabling the power of genomics to improve human health. Their focus on innovation and collaborating with our customers has transformed our company.

Our investment in expanding the commercial organization is driving returns. In 2022, we grew the Sequel II/IIe installed base by 37%. As a result, we entered 2023 with an installed base of more than 500 units, making Sequel II/IIe the most successful sequencer in our history. Importantly, we added approximately 60 brand-new instrument customers in the period and had record consumable revenue of $60 million.

Second, we continued to drive innovation by launching several new products focused on the end-to-end sequencing workflow. This included innovations in our sample preparation methods to lower DNA input requirements, developing automation capabilities to enable higher throughput, and delivering new software tools that allow our customers to extract more insight from their sequencing results. These improvements to our workflow set the stage for the announcement of the Revio and Onso sequencing platforms.

In October, we announced two new groundbreaking sequencing instruments, Revio, a long-read sequencer with 15-fold higher throughput than the Sequel IIe platform, and Onso, a highly differentiated short-read sequencer capable of extraordinary accuracy.

The Revio platform can sequence more than 1,300 genomes per year at 30x coverage with a consumable cost of less than $1,000 per genome. This dramatic increase in capacity and reduced cost will enable new sequencing initiatives. Our customers responded to the announcement of Revio enthusiastically, ordering 76 instruments in the fourth quarter alone. This is by far the strongest response to a new platform in our history. This past March, we began shipping the instrument commercially, setting the stage for an exciting 2023.

Onso is our new short-read sequencer developed for our proprietary Sequencing by Binding (SBB®) chemistry, which we acquired from Omniome, Inc. in 2021. This revolutionary new sequencing chemistry can sequence at an extraordinary level of accuracy. Customer response has been extremely positive in our beta program, with one partner reporting accuracy above Q50 levels (1 error in every 100,000 bases!) through the entire sequencing run. We expect to begin commercialization of this platform during the second quarter of 2023.

The third part of our strategy was to collaborate with leading institutions around the world to demonstrate the power of HiFi sequencing. Some examples of the progress made during 2022 follow. In rare disease, new research was published in *Genomics in Medicine* demonstrating that using PacBio HiFi in pediatric rare disease research can significantly improve the understanding of the genetic drivers behind these rare disorders. Additionally, during the year, the first human pangenome reference was published with researchers using PacBio HiFi sequencing to make significant contributions to this important new reference genome. Also in 2022, published in *Science,* researchers shared the first telomere-to-telomere human genome. These landmark insights would likely not have been possible without PacBio HiFi long-read sequencing.

Looking forward to 2023, our focus will be on accelerating our business. In particular, in the first half of the year, we will focus on continuing the success of the Revio launch. This includes driving instrument placements, scaling manufacturing to support demand, and ensuring each customer has an excellent experience with their new Revio system.

Additionally, in the first half of 2023, we plan to incorporate feedback from our Onso beta partners into the final phase of development and prepare for the commercial launch, which we anticipate in late second quarter. We then plan to spend the second half of 2023 demonstrating the utility of SBB chemistry, driving demand, and scaling Onso manufacturing. We also plan to focus our efforts in 2023 on improving our workflows and supporting our customers with new informatics tools that leverage the power of HiFi.

As you can see, we believe 2023 promises to be a transformational year for PacBio!

In conclusion, on behalf of the Board of Directors and our employees, I'd like to thank our stockholders for their support in a challenging yet highly productive 2022. As a result of this support, we believe we are now the only company with leading long and short-read technologies that will enable us to offer our customers highly differentiated products and create stockholder value.

I look forward to updating you on our progress over the course of the year.

Sincerely,

Christian Henry

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 December 31, 2022

Or

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

For the transition period from to

Commission File Number 001-34899

Pacific Biosciences of California, Inc.

(Exact name of registrant as specified in its charter)

Delaware	**16-1590339**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
1305 O'Brien Drive Menlo Park, CA 94025	**94025**
(Address of principal executive offices)	**(Zip Code)**

(Registrant's telephone number, including area code)

(650) 521-8000

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, par value $0.001 per share	**PACB**	**The NASDAQ Stock Market LLC**

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

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

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

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

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post 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	☐	Smaller reporting company	☐
		Emerging growth company	☐

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

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. Yes ☒ No ☐

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

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

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

Aggregate market value of registrant's common stock held by non-affiliates of the registrant on June 30, 2022, based upon the closing price of Common Stock on such date as reported by NASDAQ Global Select Market, was approximately $991,868,509. Shares of voting stock held by each officer and director have been excluded in that such persons may be deemed to be affiliates. This assumption regarding affiliate status is not necessarily a conclusive determination for other purposes.

Number of shares outstanding of the registrant's common stock as of January 31, 2023: 247,079,374

DOCUMENTS INCORPORATED BY REFERENCE:

Portions of the registrant's definitive Proxy Statement relating to its 2023 Annual Meeting of Stockholders are incorporated by reference into Part III of this Annual Report on Form 10-K where indicated. Such Proxy Statement will be filed with the U.S. Securities and Exchange Commission within 120 days after the end of the fiscal year to which this report relates.

Pacific Biosciences of California, Inc.
Annual Report on Form 10-K
For the Fiscal Year Ended December 31, 2022
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SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K, including the sections titled "Business," "Risk Factors" and "Management's Discussion and Analysis of Financial Condition and Results of Operations" contain or may contain forward-looking statements that are based on the beliefs and assumptions of the management of Pacific Biosciences of California, Inc. (the "Company," "we," "us," or "our") and on information currently available to our management. The statements contained in this Annual Report on Form 10-K that are not purely historical are forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and include, but are not limited to:

- the availability, uses, accuracy, sensitivity, advantages, compatibility, pricing, specifications, quality, or performance of, or benefits or expected benefits or using, our products or technologies, including the Revio™ and Onso™ systems;
- our current and future products;
- our strategic and commercial plans, including our expectations and plans for the commercial launches of the Revio and Onso systems;
- our market opportunity, including market size and expected market growth;
- our expectations regarding the conversion of backlog to revenue and the pricing and gross margin for products;
- our manufacturing plans including developing and scaling of manufacturing and delivery of our products;
- our research and development plans;
- the anticipated impact of the COVID-19 pandemic on our business, business plans and results of operations;
- our product development including, among other things, statements relating to future uses, quality, or performance of, or benefits of using, products or technologies, updates, or improvements of our products;
- our intentions regarding seeking regulatory approval for our products;
- our competitive landscape, including competition in the short- and long-read sequencing technologies markets;
- our expectations regarding collaborations and partnerships;
- our expectations regarding unrecognized income tax benefits;
- our expectations regarding market risk, including interest rate changes and general macroeconomic conditions;
- the sufficiency of cash, cash equivalents, and investments to fund projected operating requirements;
- the effects of recent accounting pronouncements on our financial statements; and
- other future events.

Forward-looking statements can be identified by words such as: "anticipates," "believes," "could," "estimates," "expects," "intends," "may," "plans," "potential," "predicts," "projects," "seeks," "should," "target," "will," "would," or similar expressions and the negatives of those terms. Forward-looking statements involve known and unknown risks, uncertainties, and other factors that may cause our actual results, performance, or achievements to be materially different from any future results, performance, or achievements expressed or implied by the forward-looking statements.

Factors that could cause or contribute to such differences include, but are not limited to, those discussed under the heading "Risk Factors" in this report and in other documents we file with the Securities and Exchange Commission (SEC). Given these risks and uncertainties, you should not place undue reliance on forward-looking statements. Also, forward-looking statements represent management's beliefs and assumptions as of the date of this report. Except as required by law, we assume no obligation to update forward-looking statements publicly, or to update the reasons actual results could differ materially from those anticipated in these forward-looking statements, even if new information becomes available in the future.

This Annual Report on Form 10-K also contains estimates, projections, and other information concerning our industry, our business, and the markets for our products, including data regarding the estimated size and estimated growth for those markets. Information that is based on estimates, forecasts, projections, market research, or similar methodologies is inherently subject to uncertainties and actual events or circumstances may differ materially from events and circumstances reflected in this information. Unless otherwise expressly stated, we obtained this industry, business, market, and other data from reports, research surveys, studies, and similar data prepared by market research firms and other third parties, industry, medical and general publications, government data, and similar sources.

ITEM 1. BUSINESS

Overview

We are a premier life science technology company that is designing, developing, and manufacturing advanced sequencing solutions that enable scientists and clinical researchers to improve their understanding of the genome and ultimately, resolve genetically complex problems.

Our products and technology under development stem from two highly differentiated core technologies focused on accuracy, quality, and completeness, which include our existing HiFi long-read sequencing technology and our emerging Sequencing by Binding (SBB®) short-read sequencing technology. Our products address solutions across a broad set of applications including human genomics sequencing, plant and animal sciences, infectious disease and microbiology, oncology, and other emerging applications. Long-read sequencing was recognized by the journal *Nature Methods* as its "method of the year" for 2022 for its contributions to biological understanding and future potential.

Our focus is on providing our customers with advanced sequencing technologies with higher throughput and improved workflows that we believe will enable dramatic advancements in routine healthcare.

Our customers include academic and governmental research institutions, commercial testing and service laboratories, genome centers, public health labs, hospitals and clinical research institutes, contract research organizations (CROs), pharmaceutical companies, and agricultural companies.

Recent Developments

On October 25, 2022, we announced two new sequencing platforms, Revio™ and Onso™.

Revio is a new long-read sequencing system designed to enable the use of HiFi sequencing for large studies in human genetics, cancer research, and agricultural genomics. We began taking orders for Revio in the fourth quarter of 2022 and expect to commence commercial Revio shipments in March 2023.

Onso, a short-read DNA sequencing system, is designed to deliver industry-leading sensitivity and specificity for novel insights in oncology, disease research, and other applications. We commenced the beta program for Onso in the fourth quarter of 2022. We began taking orders for Onso during the first quarter of 2023 and remain on track for commercial shipment in the second quarter of 2023.

Our Mission and Impact

Our mission is to enable the promise of genomics to better human health. Genomics is core to all biological processes, and our advanced genomics tools provide scientists and clinical researchers with the insights to better understand biology and health. The "promise of genomics" postulates that medicine, agriculture, public health, drug development, and other disciplines will be fundamentally transformed with the incorporation of routine genomic information over the coming decades. We see early progress toward this transformation in the applied use of genomics in areas such as genetic disease, oncology, and sustainable food production. However, legacy genomics technologies have fundamental limitations in progressing these fields toward the promise of genomics. We believe that unleashing the full potential of genomics will require a level of accuracy and completeness that is inaccessible to legacy technologies. Accuracy and completeness are central to our product development strategy, and thus we have created some of the most innovative and high-quality genomics solutions on the market. Our products also have enhanced multi-omic capabilities to look beyond the genome to the transcriptome and epigenome, which we believe is key to deep understanding.

The Underlying Science

Genetic inheritance in living systems is conveyed through a naturally occurring information storage system known as deoxyribonucleic acid, or DNA. DNA stores information in linear chains of the chemical bases adenine, cytosine, guanine, and thymine, represented by the symbols A, C, G, and T respectively.

In humans, the genome is comprised of approximately three billion DNA base-pairs, which are divided into 23 chromosomes ranging in size from 50 million to 250 million bases. A human carries two copies of the chromosomes, one inherited from each parent. There are approximately 23,000 smaller regions within these chromosomes, called genes, which contain the blueprints for protein production. The proteins synthesized from these blueprints essentially underlie the operation of all biological systems.

Genome sequencing reads the bases of long fragments of nucleic acids. Initial genome sequencing studies have shown that mutations in these DNA base-pairs play a critical role in human disease, contributing to the burgeoning field of genomics. Since then, recent discoveries have highlighted additional complexities of DNA and ribonucleic acid, or RNA. These discoveries include the presence of chemical modifications to the bases, such as methylation, and post-translational modification, or the processing of RNA molecules after they are transcribed from the genome, both of which can affect protein synthesis.

Our Principal Markets

Researchers utilize our solutions in human genomics, plant and animal sciences, infectious disease and microbiology, oncology, and other emerging applications.

Human Genomics: Improving rare disease research and understanding

According to a World Health Organization publication, it is estimated that 400 million people worldwide are affected by up to 8,000 distinct rare diseases, with 80% of these believed to be genetic in nature. These genetic diseases are DNA differences, called variants, in the affected individuals. Variants range in size from single nucleotide substitutions to large losses or gains of entire chromosomes. Other sequencing technologies applied to rare disease diagnosis are technologically limited to interrogating small variants, representing only a subset of possible genomic variation. Consequently, most genetic disease cases are undiagnosed, leaving families on multi-year diagnostic odysseys. Sequencing the human genome with long and accurate reads enables the potential detection of all known classes of disease-causing variation. In addition, the ability of PacBio's long-read sequencing technology to detect 5-Methylcytosine DNA methylation, an epigenetic modification shown to alter gene behavior, may enable further advances in research and development in genetic disease diagnosis.

Infectious Disease and Microbiology: Understanding and tracking microbes and pathogens in support of global public health

Our technology has increased the scientific community's understanding of microorganisms and viruses and their malignancy, transmission, and potential resistance to antibiotics or vaccines. Our sequencing technology delivers highly comprehensive and complete genomes, enabling federal agencies, public health organizations, and healthcare providers to conduct wide-ranging research and surveillance activities to:

- generate high quality, complete genome assemblies, revealing variants of all known types, to gain a deeper understanding of community-acquired and hospital-associated infections and transmissions;
- identify and characterize pathogens to inform regional, national, and global public health agencies for preparation and response to rapidly evolving microorganisms; and
- characterize complex microbial communities to understand their role in human, animal, and environmental health.

Oncology: Enable the discoveries of underlying causes of cancer, progression, and relapse

Understanding the cellular and molecular complexity of tumor cells is critical in developing more effective targeted cancer therapies. Single-cell transcriptomics is particularly impactful in defining cellular identity and function; however, other technologies miss critical information by only sequencing a portion of RNA. Our long-read RNA sequencing method, single-cell Iso-Seq (scIso-Seq), accurately detects molecular events such as RNA isoforms and expressed mutations and provides gene expression information at the single-cell level. We believe scIso-Seq is uniquely positioned to enable discoveries by researchers of the underlying causes of cancer initiation, progression, and relapse, as well as the discovery by researchers of novel diagnostic, prognostic, and predictive biomarkers that may inform future clinical tests.

As novel discoveries continue to be made using our long-read sequencing technology, we believe our SBB short-read sequencing technology will enable us to meet the demands of customers in the expanding non-invasive testing market in oncology. Due to the small amounts of circulating tumor DNA (ctDNA) present in the blood of early-stage cancer patients and those with minimal residual disease (MRD), the presence of cancer often goes undetected, and a more sensitive assay will be required. Based on testing internally and at beta customer sites, we believe our SBB technology has the potential to offer higher accuracy than competitor sequencing technologies, which may in the future support our customers' development of more sensitive tests for the purpose of earlier detection and more robust monitoring of cancer.

Plant and Animal Sciences: Helping scientists answer biological questions across a broad range of plant and animal sciences

There are hundreds of thousands of distinct plant and animal species. Our technology is used to build *de novo* reference genomes for these organisms across several global initiatives which are dedicated to preserving, monitoring, and cataloging biodiversity with actionable and accurate genomic data.

Our Technology, Products, and Solutions

We have developed HiFi long-read sequencing based on Single-Molecule Real-Time (SMRT) technology, which accurately detects the nucleotide sequence and epigenetic status of individual DNA molecules. We are also expanding our genomic solutions with our short-read SBB chemistry, which offers sensitive sequencing for short-read applications. Upon launch of the SBB platform, we believe we will be the only company offering both native long-read and native short-read technologies into the market.

Our sales consist of sequencing instruments, nanofluidic chips (SMRT Cells), and reagents for preparing DNA and performing sequencing based on our SMRT technology; reagents for DNA extraction based on our nanobind technology; and the services we perform for customers.

HiFi Long-Read Sequencing

Our HiFi long-read sequencing protocol was built upon our SMRT sequencing systems, including consumables and software, and offers customized end-to-end workflows for different sequencing applications. Highly accurate, long sequence reads simplify and accelerate data analysis algorithms, reducing the needs for error correction steps and/or assembly aspects, depending on the application.

Customers use our HiFi long-read sequencing platforms in a wide range of sequencing applications, including whole genome sequencing and *de novo* genome assembly, long-range phasing, targeted sequencing, full-length RNA and single-cell sequencing, characterization of metagenomic communities and other mixed DNA samples, viral genome sequencing, and others. Our technology is also capable of detecting epigenetic markers simultaneously by analyzing the kinetics of DNA polymerization that is affected, and thereby detectable, by epigenetic markers such as 5-methylcytosine or N^6-methyladenine.

SMRT Technology

Our proprietary SMRT Technology enables the observation of DNA synthesis as it occurs in real time by harnessing the natural process of DNA replication, which in nature is a highly efficient and accurate process actuated by DNA polymerases. DNA polymerases attach to a strand of DNA to be replicated, examine the individual base at the point it is attached, and then determine which of the four building blocks, or nucleotides (A, C, G, or T), is required to complement that individual base. After determining which nucleotide is required, the polymerases incorporate that nucleotide into the growing strand being produced.

SMRT Sequencing is based on following the activity of DNA polymerase on individual DNA molecules in real time that occurs on our SMRT Cells that are monitored and analyzed within our HiFi long-read sequencing systems: the Revio system, Sequel II system, Sequel IIe system, and Sequel system. Carried out on SMRTbell® templates, which attach hairpin adapters to the ends of double-stranded DNA molecules to be sequenced, SMRT sequencing allows for the successive sequencing of both the forward and reverse strands of the individual DNA molecule occurring multiple times, thereby allowing for the same base of the same molecule to be sequenced more than once in a sequencing run. The base calls from the serial observation of the molecule can be processed to generate the final base call in an analytical procedure called circular consensus sequencing, leading to what we have defined as our HiFi sequence reads, which have high accuracy typically being defined as having greater than 99% read accuracy, but often exceeding greater than 99.9% accuracy, according to research we performed in collaboration with other researchers, subsequently published in *Nature Biotechnology* in 2019. HiFi reads typically are 15-20 kilobases in size, depending on the input fragments, providing sufficient read length with our accuracy to support a multitude of applications across human health, plant and animal, and microbiology, according to research we performed in collaboration with other researchers, subsequently published in *Scientific Data* in 2020. The ability to generate single-DNA molecule sequence reads that are both long and highly accurate allows researchers to obtain more contiguous, complete, and accurate genomic data, thereby allowing for greater insights into the complexity of biological systems.

HiFi Long-Read Sequencing Instruments: Revio system + Sequel systems

Our Revio, Sequel, Sequel II, and Sequel IIe instruments conduct, monitor, and analyze single-molecule biochemical reactions in real time. The instruments use extremely sensitive imaging systems to collect the light pulses emitted by fluorescent reagents allowing the observation of biological processes. Computer algorithms are used to translate the information that is captured by the optics system. Using the recorded information, light pulses are converted into either an A, C, G, or T base call with associated quality metrics. Once sequencing is started, the real-time data is delivered to the system's primary analysis pipeline, which outputs base identity and quality values.

HiFi Consumables

Customers purchase proprietary consumable products to run their PacBio systems, including our SMRT Cells and reagent kits. One SMRT Cell is consumed per sequencing reaction, and scientists can choose the number of SMRT Cells they use per experiment.

We offer several reagent kits, each designed to address a specific step in the core sequencing workflow. A library preparation kit is used to convert DNA into SMRTbell double-stranded DNA library formats and includes typical molecular biology reagents, such as ligase, buffers, and exonucleases. Our binding kits include our modified DNA polymerase and are used to bind SMRTbell libraries to the polymerase in preparation for sequencing. Our core sequencing kits contain reagents required for on-instrument, real-time sequencing, including phospholinked nucleotides.

We have also developed and offer the Multiplexed Arrays Sequencing (MAS-Seq) 3' kit to enable cost-effective long-read single-cell RNA sequencing for a more complete interrogation of the transcriptome. The MAS-Seq kit takes single-cell cDNA as an input and outputs a sequencing-ready library, which enables researchers to move beyond gene counting to get full-length isoform information, characterize the full diversity of transcript isoforms at the single-cell level and ultimately reveal cell type-specific spliced isoforms and expressed variants.

In addition, we offer HiFiViral for SARS-CoV-2, our first fit-for-purpose, end-to-end solution for COVID-19 genome sequencing. This solution uses a differentiated molecular inversion probe (MIPs) design that is robust to the emergence of new variants in the COVID-19 genome and allows for detection of all known classes of variation across the entire viral genome. Both characteristics are required for efficient and effective public health surveillance programs battling the COVID-19 pandemic. The solution also includes fit-for-purpose software that enables automated variant calling and preparation of files for submission into public databases tracking the evolution of the COVID-19 genome.

SBB Short-Read Sequencing

In contrast to SMRT sequencing, SBB reads short fragments of DNA (hundreds of bases instead of kilobases) in a massively parallel manner. Current short-read next generation sequencing technologies available in the market incur various rates of errors in results. Researchers deploy multiple tactics to try to mitigate these effects, including oversampling or implementing complex library preparation methods, yet still face challenges, including missing rare variants.

We believe our proprietary SBB approach will enable researchers to address the gap in detecting rare variants, especially in complex heterogenous samples. Employing a two-phase sequencing chemistry, the SBB approach binds a dye-labeled nucleotide without incorporation into the DNA chain, then removes that base, then blocks and extends with a terminated nucleotide. Using nucleotides with single modifications, we incorporate more native bases, avoiding potential scarring due to fluorescent linker presence. This design helps avoid raw errors and we believe can help us develop a product with substantially greater accuracy than currently marketed short-read sequencing products. SBB enables simplified upfront library preparation, redefines coverage requirements, and reduces bioinformatic workload for downstream analysis. The accuracy of our novel sequencing approach has the potential to advance translational cancer research, drive higher fidelity single-cell applications, and broadly enable clinical sequencing—even in regions of the genome prone to sequencing errors with other short-read sequencing technologies.

SBB Short-Read Sequencing Instrument: Onso system

Our Onso instrument, currently under development, conducts, monitors, and analyzes SBB biochemical reactions. The instrument uses extremely sensitive imaging systems to collect the light emitted by fluorescent reagents allowing the observation of biological processes. Computer algorithms are used to translate the information that is captured by the optics system. Using the recorded information, light pulses are converted into either an A, C, G, or T base call with associated quality metrics. Once sequencing is started, the imaging data is delivered to the system's primary analysis pipeline, which outputs base identity and quality values.

SBB Consumables

After Onso's anticipated launch in the second quarter of 2023, our SBB consumable products will be available for purchase, including flow cells, clustering, and sequencing reagent kits. One flow cell and associated sequencing reagent pack is consumed per sequencing reaction. Each flow cell contains two lanes and scientists can choose to sequence different samples in each lane while additionally combining any number of flow cells needed per experiment.

We intend to offer several reagent kits, each designed to address a specific step in the core sequencing workflow. A library preparation kit is used to convert DNA into SBB compatible, double-stranded DNA library formats and includes typical molecular biology reagents, such as ligase, buffers, and exonucleases. Additionally for library preparation, our conversion kits include reagents to enable scientists to convert existing sequencing libraries into an SBB compatible format. Finally, our clustering and sequencing kits contain all reagents required for generating sequence ready clusters on flow cell and performing SBB sequencing reactions on instrument, respectively.

Our Strategy for Growth

To enable the promise of genomics, our strategy includes the following key elements:

- drive rapid adoption of Revio by converting existing Sequel II/IIe customers and attracting new PacBio customers
- demonstrate Onso's extraordinary level of accuracy in the field and show how it can transform research in needle-in-haystack applications
- progress development of ultra-high-throughput and bench top long-read sequencers and next generation SBB short-read sequencer
- leverage current infrastructure to drive toward positive cash flow
- expand partnerships across ecosystem and workflow to drive customer adoption of SBB short-read sequencing and HiFi long-read sequencing

Marketing, Sales, Service, and Support

We market our products through a global sales force and through distribution partners in Asia and Australia, certain parts of Europe, the Middle East and Africa, and Latin America. We plan to continue to invest in growing our marketing, sales, service, and support resources as we drive continued adoption of products, launch new products, and expand our customer base.

Our business is subject to seasonal trends. See the *Risk Factors* section, specifically the risk factor titled *Our operating results fluctuate from quarter to quarter and year over year, which makes our future results difficult to predict and could negatively impact the market price of our common stock* for additional information.

Customers

Our customers include academic and governmental research institutions, commercial testing and service laboratories, genome centers, public health labs, hospitals and clinical research institutes, contract research organizations (CROs), pharmaceutical companies, and agricultural companies. In general, our customers will isolate, prepare, and analyze genetic samples using PacBio sequencing systems in their own laboratories, or they will send their genetic samples to third-party service providers who in turn will sequence the samples with PacBio systems and provide the sequence data back to the customer for further analysis. For example, customers in academic research institutions may have bacteria, animal, or human DNA samples isolated from various sources while agricultural biology companies may have DNA samples isolated from different strains of rice, corn, or other crops. For the years ended December 31, 2022, 2021, and 2020, one customer accounted for approximately 12%, 13%, and 14% of our total revenue, respectively.

We believe that the majority of our current customers are early adopters of sequencing technology. By focusing our efforts on high-value applications, and developing whole product solutions around these applications, we seek to drive the adoption of our products across a broader customer base and into numerous large-scale projects. In general, the broader adoption of new technologies by mainstream customers can take a number of years.

Backlog

As of December 31, 2022, our instrument backlog was approximately $45.4 million, compared to $2.0 million as of December 31, 2021. We define backlog as purchase orders or signed contracts from our customers, which we believe are firm and for which we have not yet recognized revenue. We expect to convert this backlog to revenue during 2023; however, our ability to do so is subject to customers who may seek to cancel or delay their orders even if we are prepared to fulfill them.

Manufacturing

We manufacture sequencing instruments, SMRT cells, and reagents. Our key manufacturing and service facility in Menlo Park, California has received ISO 13485 and ISO 9001 certifications for the design, development, manufacture, distribution, installation, and servicing of its nucleic acid sequencing platforms. We utilize subcontract manufacturers for components of the manufacturing process. We purchase both custom and off-the-shelf components from a large number of suppliers and subject them to significant quality specifications. We periodically conduct quality audits of most of our critical suppliers and have established a supplier certification program. Some of the components required in our products are currently either sole sourced or single sourced.

Research and Development

We have historically made and plan to continue to make significant investments in research and development. Our research and development efforts focus on programs to develop new and existing platforms, as well as increasing throughput and decreasing costs on behalf of our customers. We are currently developing higher throughput platforms that encompass our HiFi long-read sequencing. Our mid-throughput short-read Sequencing by Binding platform, Onso, is currently under development. In addition to platform development, we also innovate across end-to-end workflows to improve usability, as well as develop new applications for the advancement of human health.

Intellectual Property

Developing and maintaining a strong intellectual property portfolio is an important element of our business. We have sought, and will continue to seek, patent protection for our SMRT and SBB technology, for improvements to our SMRT and SBB technology, as well as for any of our other technologies where we believe such protection will be advantageous.

Our current patent portfolio, including patents exclusively licensed to us, is directed to various technologies, including SMRT nucleic acid sequencing and other methods for analyzing biological samples, ZMW arrays, surface treatments, phospholinked nucleotides and other reagents for use in nucleic acid sequencing, optical short-read nucleic acid sequencing, nucleic acid preparation, and purification components and systems, processes for identifying nucleotides within nucleic acid sequences, and processes for analysis and comparison of nucleic acid sequence data. Some of the patents and applications that we own, as well as some of the patents and applications that we have licensed from other parties, are subject to U.S. government march-in rights, whereby the U.S. government may disregard our exclusive patent rights on its own behalf or on behalf of third parties by imposing licenses in certain circumstances, such as if we fail to achieve practical application of the U.S. government funded technology, because action is necessary to alleviate health or safety needs, to meet requirements of federal regulations, or to give preference to U.S. industry. In addition, U.S. government funded inventions must be reported to the government and U.S. government funding must be disclosed in any resulting patent applications.

As of December 31, 2022, we own or hold exclusive licenses to 406 issued U.S. patents, 100 pending U.S. patent applications, 396 granted foreign patents, and 158 pending foreign patent applications, including foreign counterparts of U.S. patent and patent applications. The full term of the issued U.S. patents will expire between 2023 and 2041. We also have non-exclusive patent licenses with various third parties to supplement our own large and robust patent portfolio.

Of our exclusively licensed patent applications, two issued U.S. patents are licensed to us by the Cornell Research Foundation, which manages technology transfers on behalf of Cornell University.

Other Sequencing Solutions

There are a significant number of companies offering nucleic acid sequencing equipment or consumables. These include, but are not limited to, Illumina, Inc. (“Illumina”), BGI Genomics (also known as MGI or Complete Genomics), Thermo Fisher Scientific Inc. (“Thermo”), Oxford Nanopore Technologies Ltd. (“ONT Ltd.”), Roche Holding AG (“Roche”), Qiagen N.V. (“Qiagen”), Element Biosciences, Inc. (“Element”), Bionano Genomics, Inc. (“Bionano”), Ultima Genomics, Inc. (“Ultima”) and Singular Genomics Systems, Inc. (“Singular”). These companies may have different levels of financial, technical, manufacturing, administrative, and support resources available to them. We expect the competition to intensify within the overall nucleic acid sequencing market as there are also several companies developing new sequencing technologies, products and/or services. Increased competition may result in pricing pressures, which could harm our sales, profitability, or share of supply.

In order for us to maintain and increase our sales, we will need to demonstrate that our products deliver superior performance and value as a result of our key differentiators. Our HiFi long-read sequencing will need to continue to deliver very high consensus accuracy and long-read lengths and include single-molecule, real-time resolution, with the ability to detect real-time kinetic information, fast time to result and flexibility, as well as support the breadth and depth of current and future applications.

Government Regulation

The development, testing, manufacturing, marketing, post-market surveillance, distribution, advertising, and labeling of certain medical devices, including in vitro diagnostic products and laboratory-developed tests, are subject to regulation in the United States by the Center for Devices and Radiological Health of the U.S. Food and Drug Administration (FDA) under the Federal Food, Drug, and Cosmetic Act (FDCA) and comparable state and foreign regulatory agencies. FDA defines a medical device as an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including any component part or accessory, which is (i) intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or (ii) intended to affect the structure or any function of the body of man or other animals and which does not achieve any of its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being

metabolized for the achievement of any of its primary intended purposes. Medical devices to be commercially distributed in the United States must receive from the FDA either clearance of a pre-market notification, known as 510(k), or pre-market approval pursuant to the FDC Act prior to marketing, unless subject to an exemption.

We intend to label and sell our products for research use only ("RUO") and expect to sell them to research customers in various settings, including academic institutions, life sciences and research laboratories that conduct research, and biopharmaceutical and biotechnology companies for non-diagnostic and non-clinical purposes. Our current RUO products are not intended or promoted for use in clinical practice in the diagnosis of disease or other conditions, and they are labeled for research use only, not for use in diagnostic procedures. Accordingly, we believe our products, as we intend to market them, are not subject to regulation by the FDA. Rather, while FDA regulations require that RUO products be labeled for research use only and to market and distribute RUO products in accordance with the FDA RUO guidance, the regulations do not subject RUO products to the FDA's jurisdiction or the broader pre- and post-market controls for medical devices. However, in the future, certain of our products or related applications, such as those that may be developed for clinical uses, could be subject to FDA regulation, or the FDA's regulatory jurisdiction could be expanded to include our products. If we wish to label and expand product lines to address the diagnosis of disease, regulation by governmental authorities in the United States and other countries will become an increasingly significant factor in development, testing, production, and marketing. In the future, products that we may develop in the molecular diagnostic markets, depending on their intended use, may be regulated as medical devices or in vitro diagnostic products ("IVDs") by the FDA and comparable agencies in other countries. In the U.S., if we market our products for use in performing clinical diagnostics, such products would be subject to regulation by the FDA under pre-market and post-market control as medical devices, unless an exemption applies, and we would be required to obtain either prior 510(k) clearance or prior pre-market approval from the FDA before commercializing the product. Obtaining the requisite regulatory approvals can be expensive and may involve considerable delay. Some countries have regulatory review processes that are substantially longer than U.S. processes. Failure to obtain regulatory approval in a timely manner and meet all of the local regulatory requirements including language and specific safety standards in any foreign country in which we plan to market our products could prevent us from marketing products in such countries or subject us to sanctions and fines. 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.

In November 2013, the FDA issued a final guidance on products labeled for research use only, which, among other things, reaffirmed that a company may not make any clinical or diagnostic claims about an RUO product, stating that merely including a labeling statement that the product is for research purposes only will not necessarily render the device exempt from the FDA's clearance, approval, or other regulatory requirements if the totality of circumstances surrounding the distribution of the product indicates that the manufacturer knows its product is being used by customers for diagnostic uses or the manufacturer intends such a use. These circumstances may include, among other things, written or verbal marketing claims regarding a product's performance in clinical diagnostic applications and a manufacturer's provision of technical support for such activities. If FDA were to determine, based on the totality of circumstances, that our products labeled and marketed for RUO are intended for diagnostic purposes, they would be considered medical devices that will require clearance or approval prior to commercialization. Further, sales of devices for diagnostic purposes may subject us to additional healthcare regulation. We continue to monitor the changing legal and regulatory landscape to ensure our compliance with any applicable rules, laws and regulations.

The FDA classifies medical devices into one of three classes. Devices deemed to pose lower risk to the patient are placed in either class I or II, which, unless an exemption applies, requires the manufacturer to submit a pre-market notification requesting FDA clearance for commercial distribution pursuant to Section 510(k) of the FDCA. This process, known as 510(k) clearance, requires that the manufacturer demonstrate that the device is substantially equivalent to a previously cleared and legally marketed 510(k) device or a "pre-amendment" class III device for which pre-market approval applications ("PMAs") have not been required by the FDA. This FDA review process typically takes from four to twelve months, although it can take longer. Most Class I devices are exempted from this 510(k) pre-market submission requirement. If no legally marketed predicate can be identified for a new device to enable the use of the 510(k) pathway, the device is automatically classified under the FDCA as Class III, which generally requires pre-market approval, or PMA approval. However, the FDA can reclassify or use "de novo classification" for a device that meets the FDCA standards for a Class II device, permitting the device to be marketed without PMA approval. To grant such a reclassification, FDA must determine that the FDCA's general controls alone, or general controls and special controls together, are sufficient to provide a reasonable assurance of the device's safety and effectiveness. The de novo classification route is generally less burdensome than the PMA approval process.

Devices deemed by the FDA to pose the greatest risk, such as life-sustaining, life-supporting, or implantable devices, or those deemed not substantially equivalent to a legally marketed predicate device, are placed in class III. Class III devices typically require PMA approval. To obtain PMA approval, an applicant must demonstrate the reasonable safety and effectiveness of the device based, in part, on data obtained in 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 one and two years,

although they can take longer. Both the 510(k) and the PMA processes can be expensive and lengthy and may not result in clearance or approval. 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 pre-market clearance or approval from the FDA. There would be no assurance that we could ever obtain such clearance or approval.

All medical devices, including 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 and may involve considerable delay. The regulatory approval process for such products may be significantly delayed, may be significantly more expensive than anticipated, and may conclude without such products being approved by the FDA. Without timely regulatory approval, we will not be able to launch or successfully commercialize such diagnostic products. 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. In addition, regulatory agencies may introduce new requirements that may change the regulatory requirements for us or our customers, or both.

As noted above, although our products are currently labeled and sold 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.

For example, in some cases, our customers, including laboratories that offer services as part of our certified service provider program, may use our RUO products in their own laboratory-developed tests ("LDTs") or in other FDA-regulated products for clinical diagnostic use. The FDA has historically exercised enforcement discretion in not enforcing the medical device regulations against LDTs and LDT manufacturers. However, on October 3, 2014, the FDA issued two draft guidance documents that set forth the FDA's proposed risk-based framework for regulating LDTs, which are designed, manufactured, and used within a single laboratory. In January 2017, the FDA announced that it would not issue final guidance on the oversight of LDTs and LDT manufacturers but would seek further public discussion on an appropriate oversight approach and give Congress an opportunity to develop a legislative solution. The FDA has issued warning letters to genomics labs for illegally marketing genetic tests that claim to predict patients' responses to specific medications, noting that the FDA has not created a legal "carve-out" for LDTs and retains discretion to take action when appropriate, such as when certain genomic tests raise significant public health concerns. As laboratories and manufacturers develop more complex genetic tests and diagnostic software, the FDA may increase its regulation of LDTs. Legislative and administrative proposals to amend the FDA's oversight of LDTs have been introduced in recent years, including the Verifying Accurate Leading-edge IVCT Development Act of 2021 (the "VALID Act"). In September 2022, Congress passed the FDA user fee reauthorization legislation without substantive FDA policy riders, including the VALID Act, but Congress may revisit the policy riders and enact other FDA programmatic reforms in the future. Any future legislative or administrative rule making or oversight of LDTs and LDT manufacturers, if and when finalized, may impact the sales of our products and how customers use our products, and may require us to change our business model in order to maintain compliance with these laws. We would become subject to additional FDA requirements if our products are determined to be medical devices or if we elect to seek 510(k) clearance or pre-market approval. If our products become subject to FDA regulation as medical devices, we would need to invest significant time and resources to ensure ongoing compliance with FDA quality system regulations and other post-market regulatory requirements.

If our products become subject to FDA regulation as medical devices, the regulatory clearance or approval and the maintenance of continued and post-market regulatory compliance for such products will be expensive, time-consuming, and uncertain both in timing and in outcome. Commercialization of such regulated medical devices can increase our exposure under additional laws. For example, medical device companies are subject to additional healthcare regulation and enforcement by the federal government and by authorities in the states and foreign jurisdictions in which they conduct their business and may constrain the financial arrangements and relationships through which we research, as well as sell, market and distribute any medical products for which we obtain marketing authorization. Such laws include, without limitation, state and federal anti-kickback, fraud and abuse, false claims, data privacy and security, and transparency laws and regulations related to payments and other transfers of value made to physicians and other healthcare providers. If our operations are found to be in violation of any of such laws or any other governmental regulations that apply, we may be subject to penalties, including, without limitation, administrative, civil, and criminal penalties, damages, fines, disgorgement, the curtailment or restructuring of operations, integrity oversight and reporting obligations, exclusion from participation in federal and state healthcare programs and imprisonment.

In the future, to the extent we develop any clinical diagnostic assays, we may pursue payment for such products through a diverse and broad range of channels and seek coverage and reimbursement by government health insurance programs and commercial third-party payors for such products. In the United States, there is no uniform coverage for clinical laboratory tests. The extent of coverage and rate of payment for covered services or items vary from payor to payor. Obtaining coverage

and reimbursement for such products can be uncertain, time-consuming, and expensive, and, even if favorable coverage and reimbursement status were attained for our tests, to the extent applicable, less favorable coverage policies and reimbursement rates may be implemented in the future. Changes in healthcare regulatory policies could also increase our costs and subject us to additional regulatory requirements that may interrupt commercialization of our products, decrease our revenue and adversely impact sales of, and pricing of and reimbursement for, our products.

International sales of medical devices are subject to foreign government regulations, which vary substantially from country to country. In the future, if we decide to distribute or market our diagnostic products as IVDs in Europe, such products are subject to regulation under the European Union ("EU") IVD Medical Device Regulation ("IVDR") EU 2017/746. Outside of the EU, regulatory approval needs to be sought on a country-by-country basis in order to market medical devices. Although there is a trend towards harmonization of a quality system, standards and regulations in each country may vary substantially, which can affect timelines of introduction.

We are committed to the protection of our employees and the environment. Our operations require the use of hazardous materials that subject us to various federal, state, and local environmental and safety laws and regulations. We believe that we are in material compliance with current applicable laws and regulations. However, we could be held liable for damages and fines should contamination of the environment or individual exposures to hazardous substances occur. In addition, we cannot predict how changes in these laws and regulations, or the development of new laws and regulations, will affect our business operations or the cost of compliance.

Additionally, we must comply with complex foreign and U.S. laws and regulations, such as the U.S. Foreign Corrupt Practices Act, the U.K. Bribery Act, and other local laws prohibiting corrupt payments to governmental officials, anti-competition regulations and sanctions imposed by the U.S. Office of Foreign Assets Control, and other similar laws and regulations. Violations of these laws and regulations could result in fines and penalties, criminal sanctions, restrictions on our business conduct, and on our ability to offer our products in one or more countries, and could also materially affect our brand, our ability to attract and retain employees, our international operations, our business, and our operating results. Although we have implemented policies and procedures designed to ensure compliance with these laws and regulations, there can be no assurance that our employees, contractors, or agents will not violate our policies.

As we continue to expand our business into multiple international markets, our success will depend, in large part, on our ability to anticipate and effectively manage these and other risks associated with our international operations. Any of these risks could harm our international operations and negatively impact our sales, adversely affecting our business, results of operations, financial condition, and growth prospects.

Human Capital

As of December 31, 2022, we had 769 full-time employees. Of these employees, 352 were in research and development, 64 were in operations, 36 were in service, 204 were in marketing, sales, and customer support, and 113 were in general and administration. With the exception of our field-based sales, marketing, and service teams, the majority of our employees are in California. None of our employees are represented by labor unions or are covered by a collective bargaining agreement with respect to their employment. We have not experienced any work stoppages, and we consider our relationship with our employees to be good.

Talent Acquisition and Retention

We recognize that our employees largely contribute to our success. To this end, we support business growth by seeking to attract and retain best-in-class talent. Our talent acquisition team uses internal and external resources to recruit highly skilled candidates globally.

Total Rewards

Our total rewards philosophy has been to invest in our workforce by offering competitive and fair compensation and benefits packages. We provide employees with compensation packages that include base salary, short-term incentives such as annual bonuses and commissions, and long-term equity awards. We also offer comprehensive employee benefits, which vary by country and region, such as life, disability, and health insurance, health savings and flexible spending accounts, paid time off, paid parental leave, Employee Stock Purchase Program, and a 401(k) plan. It is our expressed intent to be an employer of choice in our industry by providing market-competitive compensation and benefits packages.

Health, Safety, and Wellness

The health, safety, and wellness of our employees is a priority in which we have always invested and will continue to do so. We provide our employees and their families with access to a variety of innovative, flexible, and convenient health and wellness programs. Program benefits are intended to provide protection and security, so employees can have peace of mind concerning events that may require time away from work or that may impact their financial well-being. These programs are highlighted regularly in our monthly human resources newsletters.

We continue our investments in, and the prioritization of, employee health, safety, and wellness in light of the COVID-19 pandemic. To protect and support our essential team members, we have implemented health and safety measures that included a mandatory vaccination policy for our U.S.-based employees, maximizing personal workspaces, changing shift schedules, and providing personal protective equipment (PPE). We have also supported access to testing by holding on-site testing clinics available to employees and their family members. We continue to monitor this evolving situation and will continue to seek programs to educate and assist employees whenever possible.

Diversity, Equity, and Inclusion

We believe a diverse workforce is critical to our success. Our mission is to value differences in races, ethnicities, religions, nationalities, genders, ages, sexual orientations, as well as education, skill sets and experience. We offer training programs on diversity awareness to help employees understand, recognize, respond, and prevent bias throughout the employee lifecycle. We are focused on inclusive hiring practices, fair and equitable treatment, organizational flexibility, and training and resources.

Training and Development

We believe in encouraging employees to becoming lifelong learners by providing ongoing learning and leadership training opportunities. We provide a scaled learning platform of on-demand and virtual classroom learning focused on personal and professional development. While we strive to provide real-time recognition of employee performance, we have a formal annual review process not only to determine pay and equity adjustments tied to individual contributions, but to identify areas where training and development may be needed.

Available Information

Our website is located at www.pacb.com. The information posted on, or that can be accessed through, our website is not incorporated by reference into this Annual Report on Form 10-K, and the inclusion of our website address is an inactive textual reference only. Our Annual Report on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, and amendments to reports filed or furnished pursuant to Sections 13(a) and 15(d) of the Securities Exchange Act of 1934, as amended, are available free of charge through the "Investor Relations" section of our website as soon as reasonably practicable after we electronically file such material with, or furnish it to, the SEC. The SEC also maintains a website that contains our SEC filings. The address of the site is www.sec.gov.

Additionally, we use our website (including the blog section of our website) as well as our Twitter account (@pacbio) as a channel of distribution for important company information and to comply with our disclosure obligations under Regulation FD. Important information, including press releases, analyst presentations, and financial information regarding us, as well as corporate governance information, is routinely posted and accessible on the "Investor Relations" section of the website, which is accessible by clicking on the tab labeled "Company - Investors" on our website home page. In addition, important information is routinely posted and accessible on the blog section of our website, which is accessible through our website at www.pacb.com/blog, as well as our Twitter account (@pacbio). The contents of our website and our Twitter account are not incorporated by reference into this Annual Report on Form 10-K or in any other report or document we file with the SEC, and any references to our website or Twitter account are intended to be inactive textual references only.

ITEM 1A. RISK FACTORS

You should carefully consider the risks and uncertainties described below, together with all of the other information in our public filings with the SEC, which could materially affect our business, financial condition, results of operations and prospects. The risks described below are not the only risks facing us. Risks and uncertainties not currently known to us or that we currently deem to be immaterial also may materially affect our business, financial condition, results of operations and prospects. In addition, any worsening of the economic environment and the ongoing COVID-19 pandemic may exacerbate the risks described below, any of which could have a material impact on us. This situation is changing rapidly, and additional impacts may arise that we are not aware of currently.

Summary Risk Factors

The following is a summary of the principal risks that could adversely affect our business, operations, and financial results. Such risks are discussed more fully below and include, but are not limited to, risks related to:

- our ability to successfully market, commercialize, and sell current and future products and related maintenance services;
- our ability to achieve profitability for our business;
- our ability to successfully leverage and integrate our acquisitions and future acquisitions;
- our ability to successfully research, develop and timely manufacture our current and future products;
- management of new product introductions and transitions, resultant costs, and ability of new products to generate promised performance;
- recent significant changes to our leadership team and resultant disruptions to our business;
- retention, recruitment, and training of senior management, key personnel, scientists and engineers;
- our ability to further penetrate nucleic acid sequencing applications, as well as grow product demand;
- our reliance on outsourcing to other companies for manufacturing certain components and sub-assemblies, some of which are sole-sourced;
- our ability to consistently manufacture our instruments and consumables to meet customers' specifications, quantity, cost, or performance requirements;
- the high amount of competition we face in our industry;
- our ability to attract customers and increase sales of current and future products;
- reliance on a limited number of customers for a significant portion of our revenues, including academic, research and government institutions;
- the complexity of our products giving rise to defects or errors;
- our unpredictable and lengthy sales cycles;
- our business, financial condition and results of operations could be adversely affected by political and economic tensions between the United States and other countries, including China and Russia;
- securing and maintaining patent or other intellectual property protection for our products and related improvements;
- current and future legal proceedings filed against us claiming intellectual property infringement;
- the potential adverse impact of health epidemics, including the ongoing COVID-19 pandemic;
- governmental regulations that burden operations or narrow the market for our products;
- evolving ethical, legal, privacy, social, and regulatory concerns regarding genetic testing;
- volatility of the price of our common stock; and
- our stock price falling as a result of future offerings or sales of securities.

Our risk factors are not guarantees that no such conditions exist as of the date hereof and should not be interpreted as an affirmative statement that such risks or conditions have not materialized, in whole or in part.

Risks Related to Our Business

The commercialization and sales of our current or future products may be unsuccessful or less successful than anticipated. While we plan to continue pursuing new products and expand into adjacent markets, we have limited experience in managing and selling multiple products and, as a result, may face challenges selling in new markets and fail to successfully carry out these initiatives, which may adversely impact our business, financial condition or results of operation.

We have made and expect to continue making substantial investments to develop new products and enhance our existing products through our acquisitions and research and development efforts. For example, we recently announced our new Revio™ long-read sequencing system in the fourth quarter of 2022, and expect to commence commercial Revio shipments in March 2023, and we are also progressing development of Onso™, our SBB short-read platform, and remain on track for commercial shipment in the second quarter of 2023. Our future success is substantially dependent on our ability to successfully develop and commercialize our products, including Revio and Onso, which are anticipated to be used in demanding scientific research that requires substantial levels of accuracy and precision. In addition, we may not be successful in transitioning our Revio and Onso products from our prior generation products, and could incur related obsolete inventory charges. Customers may also be slower that we anticipate in making new capital equipment acquisitions, especially in the current economic environment. However, due to challenges we may experience in developing and marketing our existing products and launching new products, we may not be able to effectively:

- manage the timeliness of our new product introductions and the rate at which sales of our new products may cannibalize sales of our older products or manage sales and marketing of multiple sequencing platforms;
- drive adoption of our current and future products, including the Sequel II/IIe Systems, the Revio system and products under development related to our emerging SBB technology, including the Onso system;
- maintain our competitive position by continuing to attract and retain customers for our products;
- provide appropriate levels of customer training and support for our products;
- implement an effective marketing strategy to promote awareness of our products;
- develop and implement an effective sales and distribution strategy for our current and future products;
- develop, manufacture and commercialize new products or achieve an acceptable return on our manufacturing or research and development efforts and expenses;
- comply with regulatory requirements applicable to our products;
- anticipate and adapt to changes in our market;
- accommodate customer expectations and demands with respect to our products, increase product adoption by our existing customers or develop new customer relationships;
- deliver our beta systems to our external beta testing sites or complete our external beta testing program on our currently expected timelines;
- overcome unexpected challenges discovered during beta testing;
- complete the scientific and technical validation of new products, such as Onso, on our currently expected timeline or at all;
- deliver our future products in a timely manner to our customers;
- grow our share by marketing and selling our products for new and additional applications;
- manage the significant burdens that expanding our existing or future products into current and new markets may impose on marketing, compliance, and other administrative and managerial resources;
- maintain and develop strategic relationships with vendors, manufacturers, and other industry partners to acquire necessary materials for the production of, and to develop, manufacture and commercialize, our existing or future products;
- adapt or scale our manufacturing activities to meet performance specifications and potential demand at a reasonable cost;
- avoid infringement and misappropriation of third-party intellectual property;
- obtain and maintain any necessary licenses to third-party intellectual property on commercially reasonable terms;
- obtain valid and enforceable patents that give us a competitive advantage or enforce existing patents;
- protect our proprietary technology; and
- attract, retain, and motivate qualified personnel.

The risks noted above, especially with respect to the marketing, sales, and commercialization of our products, may be heightened by the impact of current uncertain market and other conditions. In addition, a high percentage of our expenses is and will continue to be fixed. Accordingly, if we do not generate revenue as and when anticipated, we could suffer a material adverse effect on our business, financial conditions, results of operations and prospects.

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

We have generally incurred net losses each quarter since inception, and we cannot be certain if or when we will produce sufficient revenue from our operations to support our costs. Even if profitability is achieved in the future, we may not be able to sustain profitability on a consistent basis. We expect to continue to incur substantial losses and negative cash flow from operations for the foreseeable future.

Our net losses since inception and our expectation of incurring substantial losses and negative cash flow for the foreseeable future could:

- make it more difficult for us to satisfy our obligations;
- increase our vulnerability to general adverse economic and industry conditions;
- limit our ability to fund future working capital, capital expenditures, research and development and other business opportu
- increase the volatility of the price of our common stock;
- limit our flexibility to react to changes in our business and the industry in which we operate;
- place us at a disadvantage to other companies that offer nucleic acid sequencing equipment or consumables; and
- limit our ability to borrow additional funds.

In addition, inflationary pressure, including as a result of supply shortages, has adversely impacted and could continue to adversely impact our financial results, and our operating costs may increase. 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 customers may choose to reduce their business with us if we increase our pricing.

Any or all of the foregoing may have a material adverse effect on our business, operations, financial condition, and prospects. An impairment in value of our tangible or intangible assets could also be recorded as a result of weaker economic conditions.

We are not cash flow positive and may not have sufficient cash to make required payments under the terms of our debt or fund our long-term planned operations.

Our operations have consumed substantial amounts of cash since inception, and we expect to continue to incur substantial losses and negative cash flow from operations for the foreseeable future. Additional funds may not be available on terms acceptable to us or at all. We have incurred and may further incur additional debt, including the debt incurred through issuance of $900.0 million in aggregate principal amount of 1.50% Convertible Senior Notes due 2028. We may not have sufficient cash to make required payments under the terms of this debt, and should this occur, debt holders have rights senior to common stockholders to make claims on our assets. We may not be able to issue equity securities due to unacceptable terms and conditions to us in the capital markets. To the extent that we intend to raise additional funds through the sale of our common stock, downward fluctuations in our stock price could adversely affect such fundraising efforts. Furthermore, equity financings normally involve shares sold at a discount to the current market price and fundraising through sales of additional shares of common stock or other equity securities will have a dilutive effect on our existing investors. The shares may also be sold at a time when the market price for our common stock is low because we are in need of the funds, which will further dilute existing holders more than if the market price for our common stock was higher.

We believe that our growth will depend, in part, on our ability to fund our commercialization efforts and our efforts to develop new products, including any improvements to our existing products and the continued development and anticipated launch of the Revio HiFi long-read system and the Onso SBB short-read system. To the extent our existing resources are not sufficient, it may require us to delay, or even not allow us to conduct any or all of these activities that we believe would be beneficial for our future growth. We may need to raise additional funds through public or private debt or equity financing or alternative financing arrangements, which may include collaborations or licensing arrangements. If we are unable to raise funds on favorable terms, or at all, we may have to reduce our cash burn rate and may not be able to support our commercialization efforts, launching of new products, or operations, or to increase or maintain the level of our research and development activities.

If we are unable to generate sufficient cash flows or to raise adequate funds to finance our forecasted expenditures, we may have to make significant changes to our operations, including delaying or reducing the scope of, or eliminating some or all of, our development programs. We also may have to reduce sales, marketing, engineering, customer support or other resources devoted to our existing or new products, or we may need to cease operations. Any of these actions could materially

impede our ability to achieve our business objectives and could materially harm our operating results. If our cash, cash equivalents and investments are insufficient to fund our projected operating requirements and we are unable to raise capital, it could have a material adverse effect on our business, financial condition and results of operations and prospects.

We have made acquisitions and, in the future, may continue to acquire businesses, technologies or assets, form joint ventures or make other strategic investments with companies that could adversely affect our operating results, dilute our stockholders' ownership, or cause us to incur debt or significant expense.

As part of our business strategy, we have acquired and expect to continue to pursue acquisitions of complementary businesses, technologies, or assets. We may also pursue technology license arrangements, strategic alliances or investments that complement our business. In July 2021, we acquired Circulomics, and in September 2021, we acquired Omniome. As of December 31, 2022, we recorded goodwill of $410.0 million and intangible assets of $410.2 million. See *Note 2. Business Acquisitions*, in Part II, Item 8 of this Annual Report on Form 10-K.

Acquisitions and strategic transactions involve numerous risks, any of which could harm our business and negatively affect our financial condition and results of operations, including:

- intense competition for suitable acquisition targets, which could increase prices and adversely affect our ability to consummate deals on favorable or acceptable terms;
- failure or material delay in closing a transaction;
- transaction-related lawsuits or claims;
- difficulties in integrating the technologies, operations, existing contracts, and personnel of an acquired company;
- difficulties in retaining key employees or business partners of an acquired company;
- difficulties in retaining suppliers, partners, or customers of an acquired company;
- challenges with integrating the brand identity of an acquired company with our own;
- diversion of financial and management resources from existing operations or alternative acquisition opportunities;
- failure to realize the anticipated benefits or synergies of a transaction;
- difficulties in developing technology post-acquisition;
- failure to identify the problems, liabilities, or other shortcomings or challenges of an acquired company or technology, including issues related to intellectual property, regulatory compliance practices, litigation, revenue recognition or other accounting practices, or employee or user issues;
- risks that regulatory bodies may enact new laws or promulgate new regulations that are adverse to an acquired company or business;
- risks that regulatory bodies do not approve our acquisitions or business combinations or delay such approvals;
- theft of our trade secrets or confidential information that we share with potential acquisition candidates or other potential strategic partners;
- risk that an acquired company or investment in new services cannibalizes a portion of our existing business; and
- adverse market reaction to an acquisition or other strategic transaction.

To finance any acquisitions or other strategic investments, we may raise additional funds, which could adversely affect our existing stockholders and our business. If the price of our common stock is low or volatile, we may not be able to acquire other companies for stock. In addition, our stockholders may experience substantial dilution as a result of additional securities we may issue for acquisitions. Open market sales of substantial amounts of our common stock issued to stockholders of companies we acquire could also depress our stock price. Additional funds may not be available on terms that are favorable to us, or at all.

If we fail to address the foregoing risks or other problems encountered in connection with past or future acquisitions of businesses, new technologies, services, and other assets and strategic investments, or if we fail to successfully integrate such acquisitions or investments, our business, financial condition, and results of operations could be adversely affected, including potential impairments of goodwill and intangible assets.

If we are unable to successfully develop and timely manufacture our current and future products, including with respect to SMRT Cells, Sequel II/IIe Systems, Revio, Onso, and other SMRT Cell, HiFi, and SBB products under development, and related products, our business may be adversely affected.

In light of the highly complex technologies involved in our products, there can be no assurance that we will be able to manufacture and commercialize our current and future products on a timely basis or continue providing adequate support for our existing products. The commercial success of our products, including the Sequel and Sequel II/IIe Systems, and the Revio and Onso products under development, depends on a number of factors, including performance and reliability of the systems, our anticipating and effectively addressing customer preferences and demands, the success of our sales and marketing efforts, effective forecasting and management of product demand, purchase commitments and inventory levels, effective management of manufacturing and supply costs, and the quality of our products, including consumables such as SMRT Cells and reagents. Should we face delays in or discover unexpected defects during the further development or manufacturing process of instruments or consumables related to our products, including with respect to SMRT Cells, reagents, Sequel II/IIe Systems, Revio, Onso, and other SMRT Cell, HiFi, and SBB products under development, and including any delays or defects in software development or product functionality, the timing and success of the continued rollout and scaling of our products may be significantly impacted, which may materially and negatively impact our revenue and gross margin. The ability of our customers to successfully utilize our products will also depend on our ability to deliver high quality SMRT Cells and reagents. We have designed SMRT Cells and other consumables specifically for the Sequel, Sequel II/IIe, and Revio Systems, and may need to develop in the future, other customized SMRT Cells and consumables for our future products. Our production of the SMRT Cells for the Sequel and Sequel II/IIe Systems has been and may in the future, including with respect to the Revio system, be below desired levels and yields, and we have experienced and may experience in the future manufacturing delays, product or quality defects, SMRT Cell variability, and other issues. For example, the COVID–19 pandemic outbreak has impacted and could result in more pronounced impacts to our manufacturing and our ability to supply products. The performance of our consumables is critical to our customers' successful utilization of our products, and any defects or performance issues with our consumables would adversely affect our business. All of the foregoing could materially negatively impact our ability to sell our products or result in other material adverse effects on our business, operations, financial condition, operations and prospects.

The development of our products is complex and costly. Problems in the design or quality of our products may have a material and adverse effect on our brand, business, financial condition, and operating results, and could result in us losing our certifications from the International Organization for Standardization ("ISO"). If we were to lose ISO certification, then our customers might choose not to purchase products from us and this could adversely impact our ability to develop products approved for clinical uses. Unanticipated problems with our products could divert substantial resources, which may impair our ability to support our new and existing products and could substantially increase our costs. If we encounter development challenges or discover errors in our products late in our development cycle, including during external beta testing, we may be forced to undertake design and/or production changes, delay product shipments or the scaling of manufacturing or supply. The completion of the production and external testing of our beta systems may also take longer than currently planned, cost more than currently expected and the scientific and technical validation may not be completed on our currently expected timelines or at all. Such testing may also expose fundamental flaws in our products that may cause us to abandon the further development of such products.

If the continued rollout of our current and future products, including with respect to the SMRT Cell, the Sequel II/IIe, Revio, and Onso Systems, is delayed or is not successful or less successful than anticipated, then we may not be able to achieve an acceptable return, if any, on our substantial research and development efforts, and our business may be materially and adversely affected. The expenses or losses associated with delayed or unsuccessful product development or lack of market acceptance of our existing and new products, including the SMRT Cell, Sequel II/IIe Systems, Revio, and Onso, could materially and adversely affect our business, operations, financial condition, and prospects.

Our research and development efforts may not result in the benefits that we anticipate, and our failure to successfully market, sell, and commercialize our current and future products could have a material adverse effect on our business, financial condition and results of operations.

We have dedicated significant resources to developing our current products, including sequencing systems and consumables based on our proprietary SMRT sequencing technology and our Sequel and Sequel II/IIe Systems. We are also engaged in substantial and complex research and development efforts, which, if successful, may result in the introduction of new products in the future, including in connection with the SMRT Cell, the Sequel II/IIe Systems and Revio, in addition to Onso and other SBB products currently under development. Our research and development efforts are complex and require us to incur substantial expenses. We may not be able to develop, manufacture and commercialize new products, obtain regulatory approval if necessary, or achieve an acceptable return, if any, on our research and development efforts and expenses or joint research and development efforts with partners. Our joint research and development efforts with partners require significant management attention and operational resources. If we are unable to successfully manage such joint research and development efforts, our future results may be adversely impacted. For example, in January 2021, we entered into a

development agreement with Invitae, which was amended and restated on June 24, 2022 (the "Invitae Development Agreement"), regarding a multi-year collaboration for the development of a production-scale high-throughput sequencing platform. While we anticipate that in connection with the Invitae Development Agreement, we will continue to receive feedback, input and insight from Invitae in connection with our intended development of new high-throughput sequencing systems, such feedback is not contractually required and Invitae has no contractual right to participate in decisions regarding the development program for such new sequencing systems. Invitae is not contractually obligated to reimburse us for development costs under the Invitae Development Agreement. We do not expect to receive any additional revenue under the Invitae Development Agreement apart from potential purchases by Invitae of our instruments and consumables. In consideration of non-refundable Development Costs (as defined in the Invitae Development Agreement) paid by Invitae to us pursuant to the Invitae Development Agreement, we have provided Invitae with credits in connection with Invitae's anticipated purchase of currently available and in-development sequencing systems (instruments and consumables). In addition, subject to certain conditions, Invitae will be entitled to most favored pricing for our Sequel IIe systems and certain in-development systems, including the Revio system and we may be required to sell instruments to Invitae at below-market prices. Furthermore, we will need to continue to expand our internal capabilities or seek new partnerships or collaborations, or both, in order to successfully develop, market, sell and commercialize our products for and in the markets we seek to reach. If we are unable to do so or are delayed, then this could materially and adversely affect our business, operations, financial condition, and prospects.

We must successfully manage new product introductions and transitions, including with respect to the SMRT Cell, the Sequel II/IIe Systems, and the development of the Revio HiFi long-read sequencing system and the Onso SBB short-read sequencing system, and we may incur significant costs during these transitions and development, and these efforts may not result in the benefits we anticipate.

If our products and services fail to deliver the performance, scalability or results expected by our current and future customers, or are not delivered on a timely basis, our reputation and credibility may suffer, our current and future sales and revenue may be materially harmed and our business may not succeed. For instance, if we are not able to realize the benefits we anticipate from the development and commercialization of the SMRT Cell, Sequel II/IIe Systems, the Revio HiFi long-read sequencing system, and the Onso SBB short-read sequencing system, and any future products that may be developed for research, medical and clinical uses, it could have a material adverse effect on our business, financial condition and results of operations. In addition, the introduction of future products, including with respect to future long-read and short-read products, and related consumables, has and may in the future lead to our limiting or ceasing development of further enhancements to our existing products as we focus our resources on new products, and has resulted and could in the future result in reduced marketplace acceptance and loss of sales of our existing products, materially adversely affecting our revenue and operating results. The introduction of new products, including the recent announcement of our Revio system, has had and may in the future also have a negative impact on our revenue in the near-term as our current and future customers have delayed or cancelled and may in the future delay or cancel orders of existing products in anticipation of new products and we may also be pressured to decrease prices for our existing products. Our experience in managing product transitions is limited, and we have experienced, and may in the future experience, difficulty in managing or forecasting customer reactions, purchasing decisions or transition requirements with respect to newly launched products. We have incurred and may continue to incur significant costs in completing these transitions, including costs of write-downs of our products, as current or future customers transition to new products. If we do not successfully manage these product transitions, including with respect to the SMRT Cell, Sequel II/IIe Systems, the Revio and Onso Systems, and any future long-read and short-read products, our business, operations, financial condition, and prospects may be materially and adversely affected.

Our business may be adversely affected by health epidemics, including the ongoing COVID-19 pandemic.

Our business has been and could be further adversely impacted by the effects of COVID-19 or other epidemics or pandemics. Although it is not possible at this time to estimate the impact that health epidemics, including the ongoing COVID-19 pandemic, could have on our business, the continued spread of pandemics and the measures taken by the governments of countries affected could disrupt the supply chain and the manufacture of our products.

Our manufacturing partners and suppliers have been and could continue to be disrupted by conditions related to COVID-19 or other epidemics or pandemics, possibly resulting in disruption to the production of our products. If our manufacturing partners or suppliers are unable or fail to fulfill their obligations to us for any reason, we may not be able to manufacture our products and satisfy customer demand or our obligations under sales agreements in a timely manner, and our business could be harmed as a result. There is significant uncertainty relating to the long-term effect of COVID-19 on our business. Infections may resurge or become more widespread and any ensuing disruptions to business activities or supply chains could have a negative impact on our business, financial condition, and operating results. Because our semiconductor manufacturers are located in a region where immunization rates in certain communities may be low, new and emerging variants of COVID-19 could impact workforce availability at those locations and disrupt supply. For example, the Chinese government may re-impose lockdowns or similar measures to combat the spread of COVID-19 and such measures have had, and may continue to have in the future, a negative impact on manufacturing and/or supply chains, as well as customer demand for our products and demand through certain distributors.

The COVID-19 pandemic has caused us to modify our business practices, including limiting certain of our commercial operations and limiting certain employees from working in the office. We have offered, and may plan to continue to offer, a significant percentage of our employees flexibility in the amount of time they work in an office, which could adversely impact the productivity of certain employees and harm our business, including our future operating results. This may also present risks for our strategy and may present operational, cybersecurity, and workplace culture challenges that may adversely affect our business.

Even after the COVID-19 pandemic has subsided, we may continue to experience an adverse impact to our business as a result of its global economic impact, including recessionary effects and inflationary pressures. Specifically, difficult macroeconomic conditions, such as decreases in discretionary capital expenditure spending, changes to the government funding environment, a reduction in or the lapsing of COVID-19-related governmental stimulus measures, increased and prolonged unemployment or a decline in consumer confidence as a result of the COVID-19 pandemic, as well as limited or significantly reduced points of access of our products, could have a continuing adverse effect on the demand for some of our products and, consequently, related maintenance and support services. The degree of impact of COVID-19 on our business will depend on several factors, such as the duration and the extent of the pandemic, the risk of waning immunity among persons already vaccinated and an increase in fatigue or skepticism with respect to initial or booster vaccinations, as well as actions taken by governments, businesses, and consumers in response to the pandemic, all of which continue to evolve and remain uncertain at this time.

Significant changes to our leadership team and the resulting management transitions might harm our future operating results.

We have experienced significant changes to our leadership team. Our President and Chief Executive Officer Christian O. Henry was appointed effective September 14, 2020, succeeding Dr. Michael Hunkapiller who retired on December 31, 2020. Our Chief Financial Officer Susan G. Kim was appointed effective September 28, 2020, succeeding Susan K. Barnes who retired on August 7, 2020. Our Chief Operating Officer Mark Van Oene was appointed effective January 8, 2021. Jeff Eidel was appointed Chief Commercial Officer effective August 16, 2022, succeeding Peter Fromen who resigned effective May 20, 2022. Also, our Vice President and Chief Accounting Officer Michele Farmer was appointed effective May 17, 2021, and our Chair of the Board Dr. John F. Milligan was appointed effective September 14, 2020.

Although we believe these leadership transitions are in the best interest of our stakeholders, these transitions may result in the loss of personnel with deep institutional or technical knowledge. Further, the transition could potentially disrupt our operations and relationships with employees, suppliers, partners, and customers due to added costs, operational inefficiencies, decreased employee morale and productivity and increased turnover. We must successfully recruit and integrate our new leadership team members within our organization to achieve our operating objectives; as such, the leadership transition may temporarily affect our business performance and results of operations while the new members of our leadership team become familiar with our business. In addition, our competitors may seek to use this transition and the related potential disruptions to gain a competitive advantage over us. Furthermore, these changes increase our dependency on the other members of our leadership team that remain with us, who are not contractually obligated to remain employed with us and may leave at any time. Any such departure could be particularly disruptive given that we are already experiencing leadership transitions and, to the extent we experience additional management turnover, competition for top management is high such that it may take some time to find a candidate that meets our requirements. Our future operating results depend substantially upon the continued service of our key personnel and in significant part upon our ability to attract and retain qualified management personnel. If we are unable to mitigate these or other similar risks, our business, results of operations and financial condition may be materially and adversely affected.

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 scientists, engineers, sales personnel and other employees, our ability to maintain, develop and commercialize our products could be harmed and we may be unable to achieve our goals.

Our success depends upon the continuing services of members of our senior management team and scientific and engineering personnel. In particular, our scientists and engineers are critical to our technological and product innovations, and we will need to hire additional qualified personnel. Our industry, particularly in the San Francisco Bay Area, is characterized by high demand and intense competition for talent, and the turnover rate has been and may continue to 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. This competition has become exacerbated by the increase in employee resignations in 2021 and continued high rates of employee turnover continuing through 2022 that have been experienced by us and reported by employers nationwide. In addition, we have experienced significant turnover in our senior management team in recent periods. To induce valuable employees to remain at our company, in addition to salary and cash incentives, we have issued stock options and restricted stock units that vest over time. The value to employees of stock options and restricted stock units that vest over time may be significantly affected by movements in our stock price that are beyond our control and may at any time be insufficient to counteract more lucrative offers from other companies. We may face challenges in retaining and recruiting such individuals due to sustained declines in our stock price that could reduce the retention value of equity awards. The loss of qualified employees, or an inability to attract, retain, and motivate employees, could prevent us from pursuing collaborations and materially and adversely affect our support of existing products, product development and launches, business growth prospects, results of operations and financial condition. In addition, we will need to continue to recruit, hire and retain sales personnel to support the commercialization of our existing and new products. Our employees could leave our company with little or no prior notice and would be free to work for a competitor. In addition, changes to U.S. immigration policies, particularly to H-1B and other visa programs, could restrain the flow of technical and professional talent into the U.S. and may inhibit our ability to hire qualified personnel. If one or more of our senior executives or other key personnel were unable or unwilling to continue in their present positions, we may 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 any member of our management team or other key personnel. Further, our vaccination and return to office protocols related to COVID-19 may also impact the recruitment and retention of key employees. The loss of any of these individuals or any inability to attract or retain qualified personnel, including scientists, engineers, sales personnel and others, could prevent us from pursuing collaborations and materially and adversely affect our support of existing products, product development and introductions, business growth prospects, results of operations and financial condition.

Our success is highly dependent on our ability to further penetrate nucleic acid sequencing applications as well as on the growth and expansion of the demand for our products. If our products fail to achieve and sustain sufficient market acceptance, we will not generate expected revenue and our business may not succeed.

Although nucleic acid sequencing technology is well-established, our SMRT Sequencing technology is relatively new and evolving. We cannot be sure that our current or future products will gain acceptance in the marketplace at levels sufficient to support our costs. Our success depends, in part, on our ability to expand overall demand for nucleic acid sequencing to include new applications that are not practicable with other current technologies and to introduce new products that capture a larger share of growing overall demand for sequencing. To accomplish this, we must successfully commercialize, and continue development of, our proprietary SMRT Sequencing technology for use in a variety of life science and other research applications, including uses by academic, government and clinical laboratories, as well as pharmaceutical, diagnostic, biotechnology, and agriculture companies, among others. However, we may be unsuccessful in these efforts and the sale and commercialization of the SMRT Cell, Sequel II/IIe Systems, and anticipated sale and commercialization of Revio and Onso, and related products may not grow sufficiently to cover our costs.

There can be no assurance that we will be successful in adding new products or securing additional customers for our current and future products, including with respect to the SMRT Cell, Sequel II/IIe Systems, Revio and Onso. If we are unable to successfully develop SBB technology and sell acquired technology products, we may fail to achieve our strategic commercial initiatives in connection with the planned release of new products and anticipated entry into new markets. Our ability to further penetrate existing applications and any new applications depends on a number of factors, including the cost, performance and perceived value associated with our products, as well as customers' willingness to adopt a different approach to nucleic acid sequencing. Potential customers may have already made significant investments in other sequencing technologies and may be unwilling to invest in new technologies. We are experiencing pricing pressures caused by industry competition and increased demand for lower-priced instruments and lower operational costs. We have limited experience commercializing and selling products outside of the academic and research settings, and we cannot guarantee success in acquiring additional customers. Furthermore, we cannot guarantee that our products will be satisfactory to potential customers or that our products will perform in accordance with customer expectations.

Nucleic acid sequencing applications are new and dynamic, and there can be no assurance that they will develop as quickly as we anticipate, that they will reach their full potential or that our products will be appropriate or competitive for these applications. As a result, we may be required to refocus our marketing efforts, and we may have to make changes to the specifications of our products to enhance our ability to enter particular applications more quickly. We may also need to delay full-scale commercial deployment of new products as we develop them in order to perform quality control and early access user testing. We also need to maintain reliable supply chains for the various components in our new products and consumables to support large-scale commercial production. Even if we are able to implement our technology successfully, we and/or our sales and distribution partners may fail to achieve or sustain market acceptance of our current or future products across the full range of our intended life science and other applications. We need to continue to expand and update our internal capabilities or to collaborate with other partners, or both, in order to successfully expand sales of our products in the applications that we seek to reach, which we may be unable to do at the scale required to support our business.

If the demand for our products grows more slowly than anticipated, if we are unable to successfully scale or otherwise ensure sufficient manufacturing capacity for new products to meet demand, if we are not able to successfully market and sell our products, if competitors develop better or more cost-effective products, if our product launches and commercialization are not successful, or if we are unable to further grow our customer base or do not realize the growth with existing customers that we are expecting, our current and future sales and revenue may be materially and adversely harmed, or we may recognize an impairment loss, and our business may not succeed.

We rely on other companies for the manufacture of certain components and sub-assemblies and intend to outsource additional sub-assemblies in the future, some of which are sole sources. We may not be able to successfully scale the manufacturing process necessary to build and test multiple products on a full commercial basis, which could materially harm our business.

Our products are complex and involve a large number of unique components, many of which require precise manufacturing. The nature of our products requires customized components that are currently available only from a limited number of sources, and in some cases, single sources. We have chosen to source certain critical components from a single source, including suppliers for our SMRT Cells, reagents, and instruments. We cannot assure you that product supplies will not be limited or interrupted, especially with respect to our sole source third-party manufacturing and supply collaborators, or that product supplies will be of satisfactory quality or continue to be available at acceptable prices. In particular, any replacement of our manufacturers could require significant effort and expertise because there may be a limited number of qualified replacements. We may be unable to negotiate binding agreements with our current and future sole source third-party manufacturing and supply collaborators or, in the event that such collaborators' services become interrupted for any reason, find replacement manufacturers to support our development and commercial activities at commercially reasonable terms. We do not always have arrangements in place for a redundant or second-source supply for our sole source vendors in the event they cease to provide their products or services to us or fail to provide sufficient quantities in a timely manner. If we are required to purchase these components from alternative sources, it could take several months or longer to qualify the alternative sources. If we are unable to source these product components from sole-source third-party manufacturing and supply collaborators for any reason, including in connection with acts of terrorism, hostilities, military conflict and acts of war, including between China and Taiwan, or secure a sufficient supply of these product components on a timely basis, or if these components do not meet our expectations or specifications for quality and functionality, our operations and manufacturing would be materially and adversely affected, we could be unable to meet customer demand and our business and results of operations may be materially and adversely affected.

The operations of our third-party manufacturing partners and suppliers have been and could continue to be disrupted by conditions unrelated to our business or operations or that are beyond our control, including but not limited to international trade restrictions, inflation, supply chain disruptions, and conditions related to COVID-19 or other epidemics. If our manufacturing partners or suppliers are unable or fail to fulfill their obligations to us for any reason, we may not be able to manufacture our products and satisfy customer demand or our obligations under sales agreements in a timely manner, and our business could be harmed as a result. For example, the global shortage of semiconductors, which has been reported since early 2021, has caused challenges for us in our supply chain and resulted in some cost increases that have and may continue to adversely impact margins. During these periods of shortages or delays, the price of components may increase, or the components may not be available at all. Our suppliers have raised their prices and may continue to raise prices that we may not be able to pass on to our customers, which could adversely affect our business, including our competitive position, market share, revenues, and profit margins in material ways. We may not be able to secure enough components at reasonable prices or of acceptable quality to build new products in a timely manner in the quantities or configurations needed. For example, the Chinese government may re-impose lockdowns or similar measures to combat the spread of COVID-19 and these measures have had, and may continue to have in the future, a negative impact on manufacturing and/or supply chains, in addition to customer demand for our products and demand through certain distributors. If as a result of global economic or political instability, such as the political uncertainty associated with an escalation of the war in Ukraine, potential uncertainty related to Taiwan and its relationship with China, other disease outbreaks, or supply issues, we or our contractors could experience shortages, business disruptions or delays for materials sourced or manufactured in the affected countries, and their ability to supply us with instruments or product components may be affected. From time to time, certain

components of our systems and reagents may reach the end of their life cycles or become obsoleted by our suppliers, and we would have to procure alternative sources for these end-of-life products. If we encounter delays or difficulties in securing the quality and quantity of materials we require for our products, our supply chain would be interrupted, which would adversely affect sales. If any of these events occur, our business and operating results could be harmed. Accordingly, if any of the foregoing occurs, our ability to commercialize our products, revenue and gross margins could suffer until lockdowns from COVID-19 infections are reduced, supply issues or business disruptions are resolved and/or other sources can be developed.

In addition, because our semiconductor suppliers are in regions that may have communities with low vaccination rates, the Omicron variant of COVID-19, or any variants that evolve in the future, could lead to increased infections among workers that could further disrupt the supply chain. Our current manufacturing process is characterized by long lead times between the placement of orders for and delivery of our products. If we do not accurately anticipate our needs or if we receive insufficient components to manufacture our products on a timely basis to meet customer demand, our sales and our gross margin may be adversely affected, and our business could be materially harmed. If we are unable to reduce our manufacturing costs and establish and maintain reliable, high-volume manufacturing suppliers as we scale our operations and expand our product offerings, our business, operations, financial condition, and prospects could be materially and adversely harmed.

We may be unable to consistently manufacture our instruments and consumables, including SMRT Cells and reagents, to the necessary specifications or in quantities necessary to meet demand at an acceptable cost or at an acceptable performance level.

In order to successfully generate revenue from our products, we need to supply our customers with products that meet their expectations for quality and functionality in accordance with established specifications. Our customers have experienced variability in the performance of our products. We have experienced and may continue to experience delays, quality issues or other difficulties leading to customer dissatisfaction with our products. Our production of SMRT Cells and reagents involves a long and complex manufacturing process and has been and may in the future be below desired yields and resulting output levels. We have experienced and may experience in the future manufacturing delays, product defects, variability in the performance of SMRT Cells and other products, inadequate reserves for inventory, or other issues.

There is no assurance that we will be able to manufacture our products so that they consistently achieve the product specifications and quality that our customers expect, including any products developed for clinical uses. Problems in the design or quality of our products, including low manufacturing yields of SMRT Cells, or sub-performing reagent lots may have a material adverse effect on our brand, business, financial condition, and operating results, and could result in us losing our ISO certifications. If we were to lose our ISO certifications, then our customers might choose not to purchase products from us. There is also no assurance that we will be able to increase manufacturing yields and decrease costs, particularly if high rates of inflation continue, or that we will be successful in forecasting customer demand or manufacturing and supply costs, or that product supplies, including reagents or integrated chips, will not be limited or interrupted, or will be of satisfactory quality or continue to be available at acceptable prices. Furthermore, while we are undertaking efforts to increase our manufacturing scale and capability, we may not be able to increase manufacturing to meet anticipated demand or may experience downtime in our manufacturing facilities, including, for example, if we experience increased cases of COVID-19 among our employees, or if our suppliers are unable to meet our increased demand at a time when the supply chain is under duress due to potential dislocations and disruptions in product and employee availability due to COVID-19. An inability to manufacture products and components that consistently meet specifications, in necessary quantities and at commercially acceptable costs, will have a negative impact, and may have a material adverse effect on our business, product development timelines, financial condition and results of operations.

Rapidly changing technology in life sciences and research diagnostics could make our products obsolete unless we continue to develop, manufacture and commercialize new and improved products and pursue new opportunities.

Our industry is characterized by rapid and significant technological changes, frequent new product introductions and enhancements and evolving industry standards. Our future success depends on our ability to continually improve our products, 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 opportunities. These new opportunities may be outside the scope of our proven expertise or in areas where demand is unproven, and new products and services developed by us may not gain market acceptance or may not adequately perform in order to capture market share. Our inability to develop and introduce new products and to gain market acceptance of our existing and new products could harm our future operating results. Unanticipated difficulties or delays in replacing existing products with new products or in commercializing our existing or new products in sufficient quantities and of acceptable quality to meet customer demand, including with respect to the SMRT Cell, Sequel II/IIe Systems, Revio and Onso, could diminish future demand for our products and may materially and adversely harm our future operating results.

The size of the markets for our products, including our Revio and Onso instruments, may be smaller than estimated, and new market opportunities may not develop as quickly as we expect, or at all, limiting our ability to successfully sell our products.

The market for sequencing systems and consumables products is evolving, making it difficult to accurately predict the size of the markets for our current and future products, including our Revio and Onso instruments. Our estimates of the total addressable market for our current and future products are based on a number of internal and third-party estimates and assumptions that may be incorrect, including the assumptions that academic, governmental, corporate, or other sources of funding will continue to be available to life sciences researchers at times and in amounts necessary to allow them to purchase our products. In addition, sales of new products may take time to develop and mature and we cannot be certain that these market opportunities will develop as we expect. While we believe our assumptions and the data underlying our estimates of the total addressable market for our products are reasonable, these assumptions and estimates may not be correct and the conditions supporting our assumptions or estimates, or those underlying the third-party data we have used, may change at any time, thereby reducing the accuracy of our estimates. As a result, our estimates of the total addressable market and growth opportunities for our products may be incorrect.

The future growth of the market for our current and future products depends on many factors beyond our control, including recognition and acceptance of our products by the research and scientific communities, the growth, prevalence and costs of competing products and solutions and the development of robust ecosystems supporting our products and their methodologies. For example, our long-read sequencers, such as Revio, require tools for effective, high quality sample collection and preparation as well as advanced bioinformatic tools to process results; if these tools are unavailable to our customers, whether at a reasonable cost or at all, the market acceptance and growth of our long-read sequencers, like Revio, may be negatively impaired. There can be no assurance that our current or future products will gain traction in the market. If the markets for our current and future products are smaller than estimated or do not develop as we expect, our growth may be limited, and it could materially and adversely affect our business, operations, financial condition and prospects.

Increased market adoption of our products by customers may depend on the availability of sample preparation and informatics tools, some of which may be developed by third parties.

Our commercial success may depend in part upon the development of sample preparation and software and informatics tools by third parties for use with our products. We cannot guarantee that product supplies, including reagents, will not be limited or interrupted, or will be of satisfactory quality or continue to be available at acceptable prices, or that third parties will develop tools that our current and future customers will find useful with our products, or that customers will adopt such third-party tools on a timely basis or at all. A lack of complementary sample preparation and informatics tools, or delayed updates of such tools, may impede the adoption of our products and may materially and adversely impact our business.

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.

There are a significant number of companies offering nucleic acid sequencing products and/or services, including Illumina, BGI Genomics, Thermo, ONT Ltd., Roche, Bionano, and Qiagen. Other companies recently entering the market include Ultima Genomics, Element Biosciences and Singular Genomics. Many of these companies currently have greater name recognition, more substantial intellectual property portfolios, longer operating histories, significantly greater financial, technical, research and/or other resources, more experience in new product development, larger and more established manufacturing capabilities and marketing, sales, and support functions, and/or more established distribution channels to deliver products to customers than we do. These companies may be able to respond more quickly and effectively than we can to new or changing opportunities, technologies, standards, or customer requirements.

There are also several companies that are in the process of developing or have already developed and commercialized new, competing or potentially competing technologies, products and/or services, including ONT Ltd. and its subsidiaries, against whom we have filed complaints for patent infringement in the U.S. District Court for the District of Delaware and, previously, with the U.S. International Trade Commission, in the High Court of England and Wales and in the District Court of Mannheim, Germany. ONT Ltd. previously filed claims against us in the High Court of England and Wales and the District Court of Mannheim, Germany, also for patent infringement, and its subsidiary, Oxford Nanopore Technologies, Inc. ("ONT Inc."), filed counterclaims against us in the U.S. District Court for the District of Delaware seeking declaratory judgements of non-infringement, invalidity and unenforceability of the asserted patents, as well as antitrust, false advertising and unfair competition counterclaims that were subsequently dismissed by that court. Roche is developing potentially competing sequencing products. Increased competition may result in pricing pressures, which could harm our sales, profitability or market share. Our failure to further enhance our existing products and to introduce new products to compete effectively could materially and adversely affect our business, operations, financial condition, and prospects.

We may be unable to successfully increase sales of our current products or market and sell our future products.

Our ability to achieve profitability depends, in part, on our ability to attract customers for our current and future products including Revio and Onso, and we may be unable to effectively market or sell our products or find appropriate partners to do so. To perform sales, marketing, distribution, and customer support functions successfully, we face a number of risks, including:

- our ability to attract, retain and manage qualified sales, marketing, and service personnel necessary to expand market acceptance for our technologies;
- the performance and commercial availability expectations of our existing and potential customers with respect to new and existing products;
- availability of potential sales and distribution partners to sell our technologies, and our ability to attract and retain such sales and distribution partners;
- the time and cost of maintaining and growing a specialized sales, marketing and service force for a particular application, which may be difficult to justify in light of the revenue generated; and
- our sales, marketing and service force may be unable to execute successful commercial activities.

We have enlisted and may continue to enlist third parties to assist with sales, distribution and customer support. There is no guarantee that we will be successful in attracting desirable sales and distribution partners, that we will be able to enter into arrangements with such partners on terms favorable to us or that we will be able to retain such partners on a going-forward basis. If our sales and marketing efforts, or those of any of our third-party sales and distribution partners, are not successful, or our products do not perform in accordance with customer expectations, our technologies and products may not gain market acceptance, which could materially and adversely impact our business, operations, financial condition, and prospects.

Large purchases by a limited number of customers represent a significant portion of our revenue, and any loss or delay of expected purchases has resulted, and in the future could result, in material quarter-to-quarter fluctuations of our revenue or otherwise adversely affect our results of operations.

We receive a significant portion of our revenue from a limited number of customers. For example, for the years ended December 31, 2022, 2021, and 2020, one of our customers, who is our primary distributor in China, accounted for approximately 12%, 13%, and 14% of our total revenue, respectively. Many of these customers make large purchases on a purchase-order basis rather than pursuant to long-term contracts. As a consequence of the concentrated nature of our customer base and their purchasing behavior, our quarterly revenue and results of operations have fluctuated, and may fluctuate in the future, from quarter to quarter and are difficult to forecast. For example, the cancellation of orders or acceleration or delay in anticipated product purchases or the acceptance of shipped products by our larger customers has materially affected, and in the future could materially affect, our revenue and results of operations in any quarterly period. We have been, and may in the future be, unable to sustain or increase our revenue from our larger customers, or offset any discontinuation or decrease of purchases by our larger customers with purchases by new or other existing customers. To the extent one or more of our larger customers experience significant financial difficulty, bankruptcy or insolvency, this could have a material adverse effect on our sales and our ability to collect on receivables, which could materially and adversely harm our financial condition and results of operations.

In addition, many of our customers, including some of our larger customers, have negotiated, or may in the future negotiate, volume-based discounts or other more favorable terms from us or our sales and distribution partners, which can and have had a negative effect on our gross margins or revenue.

We expect that such concentrated purchases will continue to contribute materially to our revenue for the foreseeable future and that our results of operations may fluctuate materially as a result of such larger customers' buying patterns. In addition, we may see consolidation of our customer base. The loss of one of our larger customers, a significant delay or reduction in its purchases, or any volume-based discount or other more favorable terms that we or our sales and distribution partner(s) may agree to provide, in light of the aggregated purchase volume or buying power resulting from such consolidation, has harmed, and in the future could harm, our business, financial condition, results of operations and prospects.

Our products are highly complex, have recurring support requirements and could have unknown defects or errors, which may give rise to claims against us or divert application of our resources from other purposes.

Products using our SMRT sequencing technology are highly complex and may develop or contain undetected defects or errors. Our customers have previously experienced reliability issues with our existing products, including the Sequel System and the Sequel II/IIe Systems. In addition, it is possible our customers could experience reliability issues with current or future products, including the Sequel II/IIe, Onso, and Revio Systems. Despite internal and external testing, defects, or errors may arise in our products, which could result in a failure to obtain, maintain, or increase market acceptance of our products,

diversion of development resources, injury to our reputation and increased warranty, service, and maintenance costs. New products, including Revio and Onso, or enhancements to our existing products, including the SMRT Cell and Sequel II/IIe Systems, in particular may contain undetected errors or performance problems that are discovered only after delivery to customers. If our products have reliability or other quality issues or require unexpected levels of support in the future, the market acceptance and utilization of our products may not grow to levels sufficient to support our costs and our reputation and business could be harmed. Low utilization rates of our products could cause our revenue and gross margins to be adversely affected. We provide a warranty for our sequencing instruments and consumables, which is generally limited to replacing, repairing, or at our option, giving credit for any sequencing instrument or consumable with defects in material or workmanship. Service contracts for our sequencing instruments may be separately purchased. Defects or errors in our products may also discourage customers from purchasing our products. The costs incurred in correcting any defects or errors may be substantial and could materially and adversely affect our operating margins. If our service and support costs increase, our business and operations may be materially and adversely affected.

In addition, such defects or errors could lead to the filing of product liability claims against us or against third parties whom we may have an obligation to indemnify against such claims, which could be costly and time-consuming to defend and result in substantial damages. Although we have product liability insurance, any product liability insurance that we have or procure in the future may not protect our business from the financial impact of a product liability claim. Moreover, we may not be able to obtain adequate insurance coverage on acceptable terms. Any insurance that we have or obtain will be subject to deductibles and coverage limits. A product liability claim could have a material adverse effect on our business, financial condition, and results of operations.

A significant portion of our sales depends on customers' spending budgets that may be subject to significant and unexpected variation which could have a negative effect on the demand for our products.

Our instruments represent significant capital expenditures for our customers in research applications. Current and potential customers for our current or future products include academic and government institutions, genome centers, medical research institutions, clinical laboratories, pharmaceutical, agricultural, biotechnology, diagnostic and chemical companies. Their spending budgets can have a significant effect on the demand for our products. Spending budgets are based on a wide variety of factors, including the allocation of available resources to make purchases, funding from government sources which is highly uncertain and subject to change, the spending priorities among various types of research equipment, policies regarding capital expenditures during economically uncertain periods and the impact of COVID-19. Any decrease in capital spending or change in spending priorities of our current and potential customers could significantly reduce the demand for our products. Any delay or reduction in purchases by current or potential customers or our inability to forecast fluctuations in demand could materially and adversely harm our future operating results.

We may not be able to convert our orders in backlog into revenue.

Our backlog represents product orders from our customers that we have confirmed but have not been able to fulfill, and, accordingly, for which we have not yet recognized revenue. We may not receive revenue from these orders, and any order backlog we report may not be indicative of our future revenue.

Many events can cause an order to be delayed or not completed at all, some of which may be out of our control, including the potential impacts from COVID-19 and our suppliers, especially our sole source suppliers, not being able to provide us with products or components. If we delay fulfilling customer orders or if customers reconsider their orders, those customers may seek to cancel or modify their orders with us. Customers may otherwise seek to cancel or delay their orders even if we are prepared to fulfill them. If our orders in backlog do not result in sales, our operating results may suffer.

Our sales cycles are unpredictable and lengthy, which makes it difficult to forecast revenue and may increase the magnitude of quarterly or annual fluctuations in our operating results.

The sales cycles for our sequencing instruments are lengthy because they represent a major capital expenditure and generally require the approval of our customers' senior management. This may contribute to substantial fluctuations in our quarterly or annual operating results, particularly during periods in which our sales volume is low. Because of these fluctuations, it is likely that in some future quarters our operating results will fall below the expectations of securities analysts or investors. If that happens, the market price of our stock would likely decrease. Past fluctuations in our quarterly and annual operating results have resulted in decreases in our stock price. Such fluctuations also mean that investors may not be able to rely on our operating results in any particular period as an indication of future performance. Sales to existing customers and the establishment of a business relationship with other potential customers is a lengthy process, generally taking several months and sometimes longer. Following the establishment of the relationship, the negotiation of purchase terms can be time-consuming, including as a result of seasonal factors, as discussed below, and a potential customer may require an extended evaluation and testing period. Our sales cycles may also lengthen as we introduce our Revio and Onso instruments and their associated consumables to the market, as our customers may have additional administrative, technical or other requirements associated with transitioning to new products and technologies. In anticipation of product orders, we may incur substantial costs before the sales cycle is complete and before we receive any customer payments. As a result, if a sale is not completed

or is canceled or delayed, we may have incurred substantial expenses, making it more difficult for us to become profitable or otherwise negatively impacting our financial results. Even if our selling efforts are successful, the realization of revenue may be substantially delayed, our ability to forecast our future revenue may be more limited and our revenue may fluctuate significantly from quarter to quarter and year over year. For more information on the impact of these fluctuations on our results and stock price, see "—*Our operating results fluctuate from quarter to quarter and year over year, which makes our future results difficult to predict and could negatively impact the market price of our common stock*," below.

Because some of our customers and suppliers are based in China, our business, financial condition and results of operations could be adversely affected by the political and economic tensions between the United States and China.

We are subject to risks associated with political conflicts between the U.S. and China. A significant portion of our revenue is generated from China. For example, for the years ended December 31, 2022, 2021, and 2020, one of our customers, who is our primary distributor in China, accounted for approximately 12%, 13%, and 14% of our total revenue, respectively. In addition, certain components, some of which are critical components, of our products are manufactured in China. These components are either sourced directly from companies in China or indirectly from third parties that source from companies in China.

Consequently, we are subject to significant risks associated with the trading relationship between the U.S. and China, which is currently characterized by significant uncertainty. Tariffs imposed by the U.S. and China have increased, and may continue to increase, our costs. Additionally, export restrictions imposed by the U.S. may impact our ability to export certain products to customers or distributors in China and restrict our ability to use certain integrated circuits in our products, and it is possible that additional restrictions will be put in place that could impact our ability to provide our products to customers or distributors in China or source components from China. Moreover, the Chinese government may retaliate against U.S. trade restrictions in ways that could impact our business. Given the relatively fluid regulatory environment in China and the United States and uncertainty how the U.S. or foreign governments will act with respect to export controls, tariffs, international trade agreements and policies, there could be additional import, export, tax, or other regulatory changes in the future. Any such changes could directly and adversely impact our financial results and results of operations. For more information, see "—*Enhanced trade tariffs, import restrictions, export restrictions, Chinese regulations or other trade barriers may materially harm our business.*"

Other risks could include:

- interruptions to operations in China as a result of the COVID-19 pandemic or other disease outbreaks and natural catastrophic events, which have in the past and can result in the future in business closures, transportation restrictions, import and export complications and cause shortages in the supply of raw materials or disruptions in manufacturing;
- product supply disruptions and increased costs as a result of heightened exposure to changes in the policies of the Chinese government, political unrest or unstable economic conditions in China; and
- the nationalization or other expropriation of private enterprises or intellectual property by the Chinese government.

Difficulties in this relationship may require us to take actions adverse to our business to comply with governmental restrictions on business and trade with China.

In addition, our consumable chips are partly manufactured by a company based in Taiwan. Our supply of consumables chips and other critical components may be materially and adversely affected by diplomatic, geopolitical, and other developments affecting the relationship between China and Taiwan. Accordingly, there is a risk that current political tensions between China and Taiwan may lead to circumstances that negatively affect the availability of such consumable chips and other critical components to us, which could limit or prohibit our ability to manufacture consumable chips and other critical components or lead to an increase in our supply costs if we cannot find a similar cost alternative supplier, which could materially and adversely impact our business, operations, prospects, financial condition and results, and results of operations.

Our operating results fluctuate from quarter to quarter and year over year, which makes our future results difficult to predict and could negatively impact the market price of our common stock.

We operate on a December 31st year-end and believe that there are significant seasonal factors which may cause sales of our products, and particularly our sequencing instruments, to vary on a quarterly or yearly basis, contribute to lengthy sales cycles for our sequencing instruments, and increase the magnitude of quarterly or annual fluctuations in our operating results. We believe that this seasonality results from a number of factors, including the procurement and budgeting cycles of many of our customers, especially government-funded customers, which often coincide with government fiscal year ends. For example, the U.S. government's fiscal year-end occurs in our third quarter and may result in increased sales of our products during this quarter if government-funded customers have unused funds that may be forfeited, or future budgets that may be reduced if funds remain unspent at fiscal year-end. Furthermore, Lunar New Year celebrations, which occur during our first quarter, and may last for a week or longer, resulting in closure of many of our customers' offices in China and across the Asia-Pacific region have caused, and may in the future cause, decreased sales of our consumables during our first quarter. These factors have contributed, and in the future may contribute, to substantial fluctuations in our quarterly operating results.

Our operating results during any given period can also be impacted by numerous other factors, including the following:

- market acceptance for our products;
- our ability to attract new customers;
- the length of our sales cycles, as discussed above;
- our ability to achieve economies of scale and other manufacturing efficiencies at the rate we anticipate;
- publications of studies by us, our competitors or third parties;
- the timing and success of new product introductions by us or our competitors or other changes in the competitive dynamics of our industry, such as consolidation;
- the amount and timing of our costs and expenses;
- changes in our pricing policies or those of our competitors;
- general economic, industry and market conditions;
- the regulatory environment in which we operate;
- expenses associated with warranty obligations or unforeseen product quality issues;
- the hiring, training, and retention of key employees, including our ability to grow our sales organization;
- litigation or other claims against us for intellectual property infringement or otherwise;
- our ability to obtain additional financing as necessary;
- changes or trends in new technologies and industry standards; and the impact of COVID-19.

Consequently, it is possible that in some quarters our operating results will fall below the expectations of securities analysts or investors. If that happens, the market price of our common stock would likely decrease. These fluctuations, among other factors, also mean that our operating results in any particular period may not be relied upon as an indication of future performance. Seasonal or cyclical variations in our sales have in the past, and may in the future, become more or less pronounced over time, and have in the past materially affected, and may in the future materially affect, our business, financial condition, results of operations, and prospects.

Our ability to use net operating losses to offset future taxable income may be subject to substantial limitations, and changes to U.S. tax laws may cause us to make adjustments to our financial statements.

Under Section 382 of the Internal Revenue Code, a corporation that undergoes an "ownership change" is subject to limitations on its ability to utilize its pre-change net operating losses ("NOLs") to offset future taxable income. We believe that we have had one or more ownership changes, as a result of which our existing NOLs are currently subject to limitation. Future changes in our stock ownership could result in additional ownership changes, including potentially material changes, under Section 382. Consequently, we may not be able to utilize some or all of our NOLs even if we attain profitability.

Our facilities in California are located near earthquake faults, and the occurrence of an earthquake or other catastrophic disaster could cause damage to our facilities and equipment, which could require us to cease or curtail operations.

Our facilities in California are located near earthquake fault zones and are vulnerable to damage from earthquakes. We are also vulnerable to damage from other types of disasters, including fire, floods, power loss, communications failures and similar events. If any disaster were to occur, our ability to operate our business at our facilities would 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.

Risks Related to Our Intellectual Property

Failure to secure patent or other intellectual property protection for our products and improvements to our products may reduce our ability to maintain any technological or competitive advantage over our current and potential competitors.

Our ability to protect and enforce our intellectual property rights is uncertain and depends on complex legal and factual questions. Our ability to establish or maintain a technological or competitive advantage over our competitors may be diminished because of these uncertainties. For example:

- we or our licensors might not have been the first to make the inventions covered by each of our pending patent applications or issued patents;
- we or our licensors might not have been the first to file patent applications for these inventions;
- it is possible that neither our pending patent applications nor the pending patent applications of our licensors will result in issued patents;
- the scope of the patent protection we or our licensors obtain may not be sufficiently broad to prevent others from practicing our technologies, developing competing products, designing around our patented technologies or independently developing similar or alternative technologies;
- our and our licensors' patent applications or patents have been, are and may in the future be, subject to interference, opposition or similar administrative proceedings, which could result in those patent applications failing to issue as patents, those patents being held invalid or the scope of those patents being substantially reduced;
- our enforcement of patents and proprietary rights in other countries may be problematic or unpredictable;
- we may not be able to prevent third parties from practicing our inventions in all countries outside the United States, or from selling or importing products made using our inventions in and into the United States or other jurisdictions;
- we or our partners may not adequately protect our trade secrets;
- we may not develop additional proprietary technologies that are patentable; or
- the patents of others may limit our freedom to operate and prevent us from commercializing our technology in accordance with our plans.

The occurrence of any of these events could impair our ability to operate without infringing upon the proprietary rights of others or prevent us from establishing or maintaining a competitive advantage over our competitors.

Variability in intellectual property laws may adversely affect our intellectual property position.

Intellectual property laws, and patent laws and regulations in particular, have been subject to significant variability either through administrative or legislative changes to such laws or regulations or changes or differences in judicial interpretation, and it is expected that such variability will continue to occur. Additionally, intellectual property laws and regulations differ by country. Variations in the patent laws and regulations or in interpretations of patent laws and regulations in the United States and other countries may diminish the value of our intellectual property and may change the impact of third-party intellectual property on us. Accordingly, we cannot predict the scope of the patents that may be granted to us with certainty, the extent to which we will be able to enforce our patents against third parties or the extent to which third parties may be able to enforce their patents against us.

Some of the intellectual property that is important to our business is owned by other companies or institutions and licensed to us, and changes to the rights we have licensed may adversely impact our business.

We license from third parties some of the intellectual property that is important to our business. If the third parties who license intellectual property to us fail to maintain the intellectual property that we have licensed, or lose rights to that intellectual property, the rights we have licensed may be reduced or eliminated, which would eliminate barriers against our competition. Termination of these licenses or reduction or elimination of our licensed rights may result in our having to negotiate new or reinstated licenses with less favorable terms, or could subject us to claims of intellectual property infringement or contract breach in litigation or other administrative proceedings that could result in damage awards against us and injunctions that could prohibit us from selling our products. In addition, some of our licenses from third parties limit

the field in which we can use the licensed technology. Therefore, in order for us to use such licensed technology in potential future applications that are outside the licensed field of use, we may be required to negotiate new licenses with our licensors or expand our rights under our existing licenses. We cannot be certain that we will be able to obtain such licenses or expanded rights on reasonable terms or at all. In the event a dispute with our licensors were to occur, our licensors may seek to renegotiate the terms of our licenses, increase the royalty rates that we pay to obtain and maintain those licenses, limit the field or scope of the licenses, or terminate the license agreements. In addition, we have limited rights to participate in the prosecution and enforcement of the patents and patent applications that we have licensed. If we fail to meet our obligations under these licenses, or if we have a dispute regarding the terms of the licenses, these third parties could terminate the licenses, which could subject us to claims of intellectual property infringement. As a result, we cannot be certain that these patents and applications will be prosecuted and enforced in a manner consistent with the best interests of our business. Further, because of the rapid pace of technological change in our industry, we may need to rely on key technologies developed or licensed by third parties, and we may not be able to obtain licenses and technologies from these third parties at all or on reasonable terms. The occurrence of these events may have a material adverse effect on our business, financial condition or results of operations.

The measures that we use to protect the security of and enforce our intellectual property and other proprietary rights may not be adequate, which could result in the loss of legal protection for, and thereby diminish the value of, such intellectual property and other rights.

In addition to patents, we also rely upon trademarks, trade secrets, copyrights, and unfair competition laws, as well as license agreements and other contractual provisions, to protect our intellectual property and other proprietary rights. Despite these measures, any of our intellectual property rights could be challenged, invalidated, circumvented, or misappropriated. In addition, we attempt to protect our intellectual property and proprietary information by requiring our employees and consultants to enter into confidentiality and assignment of inventions agreements, and by entering into confidentiality agreements with our third-party development, manufacturing, sales, and distribution partners, who may also acquire, develop and/or commercialize alternative or competing products or provide services to our competitors. For example, Roche had certain access to our trade secrets and other proprietary information pursuant to an agreement we had entered into with Roche, subject to the confidentiality provisions thereof (certain of which provisions survive the termination of the agreement); however, Roche is developing potentially competing sequencing products. There can be no assurance that our measures have provided or will provide adequate protection for our intellectual property and proprietary information. These agreements may be breached, and we may not have adequate remedies for any such breach. In addition, our trade secrets and other proprietary information may be disclosed to others, or others may gain access to or disclose our trade secrets and other proprietary information. Enforcing a claim that a third party illegally obtained and is using our trade secrets is expensive and time consuming, and the outcome is unpredictable. Additionally, others may independently develop proprietary information and techniques that are substantially equivalent to ours. The occurrence of these events may have a material adverse effect on our business, financial condition, or results of operations.

Our intellectual property may be subject to challenges in the United States or foreign jurisdictions that could adversely affect our intellectual property position.

Our pending, issued and granted U.S. and foreign patents and patent applications have been, are and may in the future be, subject to challenges by ONT Ltd., ONT Inc. and Metrichor, Ltd. ("Metrichor" and, together with ONT Ltd. and ONT Inc., "ONT") in addition to other parties asserting prior invention by others or invalidity on various grounds, through proceedings, such as interferences, reexaminations, or opposition proceedings. Addressing these challenges to our intellectual property has been, and any future challenges can be, costly and distract management's attention and resources. For example, we previously incurred significant legal expenses to litigate and settle a complaint seeking review of a patent interference decision of the U.S. Patent and Trademark Office. Additionally, ONT previously requested that the U.S. Patent and Trademark Office institute *inter partes* reviews of certain patents that we have asserted against ONT Inc. and ONT Ltd. in litigation proceedings for patent infringement. While none of the *inter partes* reviews requested by ONT were instituted by the U.S. Patent and Trademark Office, challenges of this nature before the Patent Trial and Appeal Board ("PTAB") in the future could result in determinations that our patents or pending patent applications are unpatentable to us, or are invalidated or unenforceable in whole or in part and could require us to expend significant time, funds, and other resources in litigating such challenges. Accordingly, adverse rulings in such proceedings could negatively impact the scope of our intellectual property protection for our products and technology and could materially and adversely affect our business. Similar mechanisms for challenging the validity and enforceability of a patent exist in foreign patent offices and courts and may result in the revocation, cancellation, or amendment of any foreign patents we hold now or in the future. The outcome following legal assertions of invalidity and unenforceability is unpredictable, and prior art could render our patents invalid. If a defendant were to prevail on a legal assertion of invalidity and/or unenforceability, we would lose at least part, and perhaps all, of the patent protection on such products. Such a loss of patent protection would have a material adverse impact on our business.

Some of our technology is subject to "march-in" rights by the U.S. government.

Some of our patented technology was developed with U.S. federal government funding. When new technologies are developed with U.S. government funding, the government obtains certain rights in any resulting patents, including a nonexclusive license authorizing the government to use the invention for non-commercial purposes. These rights may permit the government to disclose our confidential information to third parties and to exercise "march-in" rights to use or allow third parties to use our patented technology. The government can exercise its march-in rights if it determines that such action is necessary to (i) achieve practical application of the U.S. government-funded technology, (ii) alleviate health or safety needs, (iii) meet requirements of federal regulations, or (iv) give preference to U.S. industry. In addition, U.S. government-funded inventions must be reported to the government and such government funding must be disclosed in any resulting patent applications. Furthermore, our rights in such inventions are subject to government license rights and foreign manufacturing restrictions. The U.S. government has generally denied requests to exercise its march-in rights, even to provide access to potentially life-saving medications; however, if the U.S. government were to exercise its march-in rights to our patent technologies funded by the U.S. government, particularly for the benefit of one of more of our competitors, that may have a material adverse effect on our business.

We are involved in legal proceedings to enforce our intellectual property rights.

Our intellectual property rights involve complex factual, scientific, and legal questions. We operate in an industry characterized by significant intellectual property litigation. Even though we may believe that we have a valid patent on a particular technology, other companies have from time to time taken, and may in the future take, actions that we believe violate our patent rights. For example, we were previously involved in legal proceedings with ONT and Harvard University in several United States and European jurisdictions. We have in the past received adverse rulings against us with respect to our complaint with the United States International Trade Commission for one of these proceedings. Legal actions to enforce our patent rights have been, and will continue to be, expensive, and may divert significant management time and resources. Adverse parties from previous legal actions have brought, and they and others may in the future bring, claims against us and/or our intellectual property. Litigation is a significant ongoing expense, recognized in sales, general and administrative expense, with an uncertain outcome, and has been, and may in the future be, a material expense for us. Our enforcement actions may not be successful, have given rise to legal claims against us and could result in some of our intellectual property rights being determined to be invalid or not enforceable. Furthermore, an adverse determination or judgement could lead to an award of damages against us, or the issuance of an injunction against us or our products that could prevent us from selling any products found to be infringing the intellectual property rights of another party.

We have been, are currently, and could in the future be, subject to legal proceedings with third parties who may claim that our products infringe or misappropriate their intellectual property rights.

Our products are based on complex, rapidly developing technologies. We may not be aware of issued or previously filed patent applications that belong to third parties that mature into issued patents that cover some aspect of our products or their use. In addition, because patent litigation is complex and the outcome inherently uncertain, our belief that our products do not infringe third-party patents of which we are aware or that such third-party patents are invalid and unenforceable may be determined to be incorrect. As a result, third parties have claimed, and may in the future claim, that we infringe their patent rights and have filed, and may in the future file lawsuits or engage in other proceedings against us to enforce their patent rights. For example, we are involved in legal proceedings for alleged patent infringement and related matters in the United States with Personal Genomics of Taiwan, Inc. ("PGI"), Take2 Technologies, Ltd., and the Chinese University of Hong Kong. In addition, ONT Ltd. and Harvard University have, in the past, filed claims against us in the High Court of England and Wales and the District Court of Mannheim, Germany for patent infringement, and PGI has filed claims against us in the U.S. District Court for the District of Delaware and in the Wuhan People's Court in China. We are aware of other issued patents and patent applications owned by third parties that could be construed to read on our products, and related maintenance and support services. Although we do not believe that our products or services infringe any valid issued patents, the third-party owners of these patents and applications may in the future claim that we infringe their patent rights and file lawsuits against us. In addition, as we enter new markets, our competitors and other third parties may claim that our products infringe their intellectual property rights as part of a business strategy to impede our successful entry into those markets. Furthermore, parties making claims against us may be able to obtain injunctive or other relief, which effectively could block our ability to further develop or commercialize products or services and could result in the award of substantial damages against us. Patent litigation between competitors in our industry is common. Additionally, we have certain obligations to many of our customers and suppliers to indemnify and defend them against claims by third parties that our products or their use infringe any intellectual property of these third parties. In defending ourselves against any of these claims, we have in the past incurred, and could in the future incur, to defend ourselves or our customers, substantial costs, and the attention of our management and technical personnel could be diverted. For example, we previously incurred significant legal expenses to litigate and settle a complaint alleging patent infringement. Even if we have an agreement that indemnifies us against such costs, the indemnifying party may be unable to uphold its contractual obligations. To avoid or settle legal claims, it may be necessary or desirable in the future to obtain licenses relating to one or more products or relating to current or future

technologies, which could negatively affect our gross margins. We may not be able to obtain these licenses on commercially reasonable terms, or at all. We may be unable to modify our products so that they do not infringe the intellectual property rights of third parties. In some situations, the results of litigation or settlement of claims may require us to cease allegedly infringing activities which could prevent us from selling some or all of our products. The occurrence of these events may have a material adverse effect on our business, financial condition, or results of operations.

In addition, in the course of our business, we may from time to time have access or be alleged to have access to confidential or proprietary information of others, which, though not patented, may be protected as trade secrets. Others could bring claims against us asserting that we improperly used their confidential or proprietary information, or that we misappropriated their technologies and incorporated those technologies into our products. A determination that we illegally used the confidential or proprietary information or misappropriated technologies of others in our products could result in us paying substantial damage awards or being prevented from further developing or selling some or all of our products, which could materially and adversely affect our business.

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.

Our use of "open source" software could adversely affect our ability to sell our products and subject us to possible litigation.

A portion of the products or technologies developed and/or distributed by us incorporate "open source" software, and we may incorporate open source software into other products or technologies in the future. Some open source software licenses require that we disclose the source code for any modifications to such open source software that we make and distribute to one or more third parties, and that we license the source code for such modifications to third parties, including our competitors, at no cost. We monitor the use of open source software in our products to avoid uses in a manner that would require us to disclose or grant licenses under our source code that we wish to maintain as proprietary; however, there can be no assurance that such efforts have been or will be successful. In some circumstances, distribution of our software that includes or is linked with open source software could require that we disclose and license some or all of our proprietary source code in that software, which could include permitting the use of such software and source code at no cost to the user. Open source license terms are often ambiguous and there is little legal precedent governing the interpretation of these licenses. Successful claims made by the licensors of open source software that we have violated the terms of these licenses could result in unanticipated obligations, including being subject to significant damages, being enjoined from distributing products that incorporate open source software and being required to make available our proprietary source code pursuant to an open source license, which could substantially help our competitors develop products that are similar to or better than ours or otherwise materially and adversely affect our business.

Risks Related to Regulation

We are, and may become, subject to governmental regulations that may impose burdens on our operations, and the markets for our products may be narrowed.

We are subject, both directly and indirectly, to the adverse impact of government regulation of our operations and markets. For example, export of our instruments may be subject to strict regulatory control in a number of jurisdictions. Following Russia's invasion of Ukraine in February 2022, the United States and other countries imposed certain economic sanctions and severe export control restrictions against Russia and Belarus as well as certain Russian nationals and individuals and entities with ties to Russia, Belarus, and this conflict. These sanctions and restrictions have continued to increase as the conflict has further escalated and now cover the export of our products to Russia, and the United States and other countries could impose even wider sanctions and export restrictions and take other actions in the future that could further limit our ability to provide products in certain locations. Additionally, new restrictions on the ability to send certain products and technology related to semiconductors, semiconductor manufacturing, and supercomputing to China without an export license discussed above impact our ability to provide products to customers or distributors in China. We have expanded and are continuing to expand the international jurisdictions into which we supply products, which increases the risks surrounding governmental regulations relating to our business. The need to or failure to satisfy export control criteria or to obtain necessary clearances could delay or prevent shipment of products, which could materially and adversely affect our revenue and profitability. Moreover, the life sciences industry, which is expected to continue to be one of the primary markets for our technology, has historically been heavily regulated. There are, for example, laws in several jurisdictions restricting research in genetic engineering, which may narrow our markets. Given the evolving nature of this industry, legislative bodies or regulatory authorities may adopt additional regulations that may adversely affect our market opportunities. Additionally, if

ethical and other concerns surrounding the use of genetic information, diagnostics or therapies become widespread, there may be less demand for our products.

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 government 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 revenue and the cost of operating our business. In addition, changes to laws and government regulations could cause a material adverse effect on our business as we will need to adapt our business to comply with such changes. For example, a governmental prohibition on the use of human *in vitro* diagnostics or other regulations that negatively impact the research and development activities of our customers would adversely impact our commercialization of products on which we have expended significant research and development resources, which would in turn have a material adverse impact on our business and prospects.

Our products could become subject to government regulation as medical devices by the U.S. Food and Drug Administration or other domestic and international regulatory agencies even if we do not elect to seek regulatory clearance or approval to market our products for diagnostic purposes, which could increase our costs and impede or delay our commercialization efforts, thereby materially and adversely affecting our business and results of operations.

Our products are currently labeled and promoted as research use only ("RUO") products, and are not currently designed, or intended to be used, for clinical diagnostic tests or as medical devices. However, in the future, certain of our products or related applications, such as those that may be developed for clinical uses, could be subject to regulation by the U.S. Food and Drug Administration ("FDA"), or the FDA's regulatory jurisdiction could be expanded to include our products. Also, even if our products are labeled, promoted, and intended as RUO, the FDA or comparable agencies of other countries could disagree with our conclusion that our products are intended for research use only or deem our sales, marketing and promotional efforts as being inconsistent with the FDA's guidance on RUO products. For example, our customers may independently elect to use our RUO labeled products in their own laboratory developed tests ("LDTs") for clinical diagnostic use, which could subject our products to government regulation, and the regulatory clearance or approval and maintenance process for such products may be uncertain, expensive, and time-consuming. Regulatory requirements related to marketing, selling, and distribution of RUO products could change or be uncertain, even if clinical uses of our RUO products by our customers were done 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. In the event that we fail to obtain and maintain necessary regulatory clearances or approvals for products that we develop for clinical uses, or if clearances or approvals for future products and indications are delayed or not issued, our commercial operations may be materially harmed. Furthermore, even if we are granted regulatory clearances or approvals, they may include significant limitations on the indicated uses for the product, which may limit the market for the product. We do not have experience in obtaining FDA approvals and no assurance can be given that we will be able to obtain or to maintain such approvals. Furthermore, any approvals that we may obtain can be revoked if safety or efficacy problems develop.

The FDA has historically exercised enforcement discretion in not enforcing the medical device regulations against laboratories developing and offering LDTs. However, in 2014, the FDA issued two draft guidance documents that set forth the FDA's proposed risk-based framework for regulating LDTs, which are designed, manufactured, and used within a single laboratory. The draft guidance documents provide the anticipated details through which the FDA would propose to establish an LDT oversight framework, including pre-market review for higher-risk LDTs, such as those that have the same intended use as FDA-approved or cleared companion diagnostic tests currently on the market. In 2017, the FDA announced that it would not issue final guidance on the oversight of LDTs, and manufacturers of products used for LDTs, but would seek further public discussion on an appropriate oversight approach, and give Congress an opportunity to develop a legislative solution. More recently, the FDA has issued warning letters to certain genomics labs for illegally marketing genetic tests that claim to predict patients' responses to specific medications, noting that the FDA has not created a legal "carve-out" for LDTs and retains discretion to take action when appropriate, such as when certain genomic tests raise significant public health concerns.

As manufacturers develop more complex diagnostic tests and diagnostic software, the FDA may increase its regulation of LDTs. Any future legislative or administrative rule making or oversight of LDTs, if and when finalized, may impact the sales of our products and how customers use our products, and may require us to change our business model in order to maintain compliance with these laws. We cannot predict how these various efforts will be resolved, how Congress or the FDA will regulate LDTs in the future, or how that regulatory system will impact our business. Changes to the current regulatory framework, including the imposition of additional or new regulations, including regulation of our products, could arise at any time during the development or marketing of our products, which may negatively affect our ability to obtain or maintain FDA or comparable regulatory approval of our products, if required. Further, sales of devices for diagnostic purposes may subject us to additional healthcare regulation and enforcement by the applicable government agencies. Such laws include, without limitation, state and federal anti-kickback or anti-referral laws, healthcare fraud and abuse laws, false claims laws, privacy

and security laws, Physician Payments Sunshine Act and related transparency and manufacturer reporting laws, and other laws and regulations applicable to medical device manufacturers.

Additionally, in 2013, the FDA issued Final Guidance "Distribution of In Vitro Diagnostic Products Labeled for Research Use Only." The guidance emphasizes that the FDA will review the totality of the circumstances when it comes to evaluating whether equipment and testing components are properly labeled as RUO. The final guidance states that merely including a labeling statement that the product is for research purposes only will not necessarily render the device exempt from the FDA's clearance, approval, and other regulatory requirements if the circumstances surrounding the distribution, marketing and promotional practices indicate that the manufacturer knows its products are, or intends for its products to be, used for clinical diagnostic purposes. These circumstances may include written or verbal sales and marketing claims or links to articles regarding a product's performance in clinical applications and a manufacturer's provision of technical support for clinical applications.

In August 2020, the Department of Health and Human Services ("HHS") announced rescission of guidance and other informal issuances of FDA regarding pre-market review of LDT absent notice-and-comment rulemaking, stating that, absent notice-and-comment rulemaking LDTs are not required to obtain FDA pre-market authorization. In November 2021, HHS under the Biden administration issued a statement that withdrew the August 2020 policy announcement stating that HHS does not have a policy on LDTs that is separate from FDA's longstanding approach.

Legislative and administrative proposals to amend the FDA's oversight of LDTs have been introduced in recent years, including the Verifying Accurate Leading-edge IVCT Development Act of 2021 (the "VALID Act"), which aims to create a new category of medical products separate from medical devices called "in vitro clinical tests," or IVCTs, and bring all such products within the scope of the FDA's oversight. To date, Congress has not passed the VALID Act, but may revisit the VALID Act or similar policy riders and enact other FDA programmatic reforms in the future. It is unclear how future legislation by federal and state governments and FDA regulation will impact the industry, including our business and that of our customers.

If the FDA determines our products or related applications should be subject to additional regulation as in vitro diagnostic devices based upon customers' use of our products for clinical diagnostic or therapeutic decision-making purposes, our ability to market and sell our products could be impeded and our business, prospects, results of operations and financial condition may be adversely affected. In addition, the FDA could consider our products to be misbranded or adulterated under the Federal Food, Drug, and Cosmetic Act and subject to recall and/or other enforcement action.

To the extent we elect to label and promote any of our products as medical devices, we would be required to obtain prior approval or clearance by the FDA or comparable foreign regulatory authority, which could take significant time and expense and could fail to result in a marketing authorization for the intended uses we believe are commercially attractive. Obtaining marketing authorization in one jurisdiction does not mean that we will be successful in obtaining marketing authorization in other jurisdictions where we conduct business.

If we elect to label and market our products for use as, or in the performance of, clinical diagnostics in the United States, thereby subjecting them to FDA regulation as medical devices, we would be required to obtain pre-market 510(k) clearance or pre-market approval from the FDA, unless an exception applies. It is possible, in the event we elect to submit 510(k) applications for certain of our products, that the FDA would take the position that a more burdensome pre-market application, such as a PMA or a *de novo* application is required for some of our products. If such applications were required, greater time and investment would be required to obtain FDA approval. Even if the FDA agreed that a 510(k) was appropriate, FDA clearance can be expensive and time consuming. It generally takes a significant amount of time to prepare a 510(k), including conducting appropriate testing on our products, and several months to years for the FDA to review a submission. Notwithstanding the effort and expense, FDA clearance or approval could be denied for some or all of our products for which we choose to market as a medical device or a clinical diagnostic device. Even if we were to seek and obtain regulatory approval or clearance, it may not be for the intended uses we request or that we believe are important or commercially attractive. There can be no assurance that future products for which we may seek pre-market clearance or approval will be approved or cleared by FDA or a comparable foreign regulatory authority on a timely basis, if at all, nor can there be assurance that labeling claims will be consistent with our anticipated claims or adequate to support continued adoption of such products. Compliance with FDA or comparable foreign regulatory authority regulations will require substantial costs, and subject us to heightened scrutiny by regulators and substantial penalties for failure to comply with such requirements or the inability to market our products. The lengthy and unpredictable pre-market clearance or approval process, as well as the unpredictability of the results of any required clinical studies, may result in our failing to obtain regulatory clearance or approval to market such products, which would significantly harm our business, results of operations, reputation, and prospects.

If we sought and received regulatory clearance or approval for certain of our products, we would be subject to ongoing FDA obligations and continued regulatory oversight and review, including the general controls listed above and the FDA's QSRs for our development and manufacturing operations. In addition, we would be required to obtain a new 510(k) clearance before we could introduce subsequent material modifications or improvements to such products. We could also be subject to

additional FDA post-marketing obligations for such products, any or all of which would increase our costs and divert resources away from other projects. If we sought and received regulatory clearance or approval and are not able to maintain regulatory compliance with applicable laws, we could be prohibited from marketing our products for use as, or in the performance of, clinical diagnostics and/or could be subject to enforcement actions, including warning letters and adverse publicity, fines, injunctions, and civil penalties; recall or seizure of products; operating restrictions; and criminal prosecution.

Further, if we decide to seek regulatory clearance or approval for certain of our products in countries outside of the United States or if a foreign regulatory authority determines that our products are regulated as medical devices, we would be subject to extensive medical device laws and regulations outside of the United States. Sales of such products outside the United States will likely be subject to foreign regulatory requirements, which can vary greatly from country to country. As a result, the time required to obtain clearances or approvals outside the United States may differ from that required to obtain FDA clearance or approval and we may not be able to obtain foreign regulatory approvals on a timely basis or at all. In Europe, we would need to comply with the Medical Device Regulation 2017/745 and In Vitro Diagnostic Regulation 2017/746, which became effective May 26, 2017, with application dates of May 26, 2021 (postponed from 2020) and May 26, 2022, respectively. This will increase the difficulty of regulatory approvals in Europe in the future. In addition, the FDA regulates exports of medical devices. The number and scope of these requirements are increasing. Unlike many of the other companies offering nucleic acid sequencing equipment or consumables, this is an area where we do not have expertise. We, or our other third-party sales and distribution partners, may not be able to obtain regulatory approvals in such countries or may incur significant costs in obtaining or maintaining our foreign regulatory approvals. In addition, the export by us of certain of our products, which have not yet been cleared for domestic commercial distribution, may be subject to FDA or other export restrictions. Failure to comply with these regulatory requirements or obtain and maintain required approvals, clearances and certifications could impair our ability to commercialize our products for diagnostic use outside of the United States. Any action brought against us for violations of these laws or regulations, even if successfully defended, could cause us to incur significant legal expenses and divert our management's attention from the operation of our business.

Enhanced trade tariffs, import restrictions, export restrictions, Chinese regulations, or other trade barriers may materially harm our business.

We are continuing to expand our international operations as part of our growth strategy and have experienced an increasing concentration of sales in certain regions outside the United States, especially the Asia-Pacific region, as discussed above. There is currently significant uncertainty about the future relationship between the United States and various other countries, most significantly China, with respect to trade policies, treaties, government regulations and tariffs. Starting in September 2018, the U.S. Trade Representative (the "USTR") enacted various tariffs of 7.5%, 10%, 15%, and 25% on the import of Chinese products, including non-U.S. components and materials that may be used in our products. Additionally, China also has imposed tariffs on imports into China from the United States. These tariffs have and could continue to raise our costs. Furthermore, tariffs, trade restrictions, or trade barriers that have been, and may in the future be, placed on products such as ours by foreign governments, especially China, have raised, and could further raise, amounts paid for some or all of our products, which may result in the loss of customers and our business, and our financial condition and results of operations may be harmed. Further tariffs may be imposed that could cover imports of components and materials used in our products, or our business may be adversely impacted by retaliatory trade measures taken by China or other countries, including restricted access to components or materials used in our products or increased amounts that must be paid for our products, which could materially harm our business, financial condition, and results of operations.

Additionally, the U.S. government recently announced new controls restricting the ability to send certain products and technology related to semiconductors, semiconductor manufacturing, and supercomputing to China without an export license. These new controls also apply to certain hardware containing these specified integrated circuits. In many cases, these licenses are subject to a policy of denial and will not be issued. These controls may impact our ability to export certain products to customers or distributors in China and restrict our ability to use certain integrated circuits in our products. The U.S. government also recently added additional entities in China to restricted party lists impacting the ability of U.S. companies to provide items to these entities. Moreover, in November 2018, the U.S. Commerce Department's Bureau of Industry and Security ("BIS") released an advance notice of proposed rulemaking to control the export of emerging technologies. This notice included "[b]iotechnology, including nanobiology; synthetic biology; genomic and genetic engineering; or neurotech" as possible areas of increased export controls. The Biden Administration has continued to provide updated lists of emerging technologies subject to national security consents, and it continues to include biotechnologies including "[g]enome and protein engineering including design tools" and "[b]iomanufacturing and bioprocessing technologies." Therefore, it is possible that our ability to export our products to customers or distributors in China may be further restricted in the future.

It is possible that the Chinese government will retaliate in response to existing or future U.S. export controls or trade restrictions in ways that could impact our business. It also is possible that additional restrictions will be put in place that could impact our ability to provide our products to customers or distributors in China or source components from China. The continued threats of tariffs, trade restrictions and trade barriers could have a generally disruptive impact on the global

economy and, therefore, negatively impact our sales. Given the relatively fluid regulatory environment in China and the United States and uncertainty how the U.S. or foreign governments will act with respect to export controls, tariffs, international trade agreements and policies, there could be additional tax or other regulatory changes in the future. Any such changes could directly and adversely impact our financial results and results of operations.

Our international business could expose us to business, regulatory, political, operational, financial, and economic risks associated with doing business outside of the United States.

Engaging in international business inherently involves a number of difficulties and risks, including:

- required compliance with existing and changing foreign regulatory requirements and laws that are or may be applicable to our business in the future, such as the European Union's General Data Protection Regulation ("GDPR") and other data privacy requirements, labor and employment regulations, anti-competition regulations, the U.K. Bribery Act of 2010 and other anti-corruption laws, regulations relating to the use of certain hazardous substances or chemicals in commercial products, and require the collection, reuse, and recycling of waste from products we manufacture;
- required compliance with U.S. laws such as the Foreign Corrupt Practices Act, and other U.S. federal laws and trade and economic sanctions and other regulations established by the Office of Foreign Asset Control;
- export requirements and import or trade restrictions;
- laws and business practices favoring local companies;
- restrictions on both inbound and outbound cross-border investment;
- foreign currency exchange, longer payment cycles and difficulties in enforcing agreements and collecting receivables through certain foreign legal systems;
- changes in social, economic, and political conditions or in laws, regulations and policies governing foreign trade, manufacturing, research and development, and investment both domestically as well as in the other countries and jurisdictions in which we operate and into which we may sell our products including as a result of the separation of the United Kingdom from the European Union ("Brexit") and ongoing geopolitical tensions related to the political uncertainty and military actions associated with the war in Ukraine, resulting sanctions imposed by the U.S. and other countries, and retaliatory actions taken by Russia in response to such sanctions;
- potentially adverse tax consequences, tariffs, customs charges, bureaucratic requirements, and other trade barriers;
- difficulties and costs of staffing and managing foreign operations; and
- difficulties protecting, maintaining, enforcing, or procuring intellectual property rights and defending against intellectual property claims under the law and judicial systems of other countries.

If one or more of these risks occurs, it could require us to dedicate significant resources to remedy such occurrence, and if we are unsuccessful in finding a solution, our financial results will suffer.

Our operations involve the use of hazardous materials, and we must comply with environmental, health and safety laws, which can be expensive and may adversely affect our business, operating results and financial condition.

Our research and development and manufacturing activities involve the use of hazardous materials, including chemicals and biological materials, and some of our products include hazardous materials. Accordingly, we are subject to federal, state, local and foreign laws, regulations, and permits relating to environmental, health and safety matters, including, among others, those governing the use, storage, handling, exposure to and disposal of hazardous materials and wastes, the health and safety of our employees, and the shipment, labeling, collection, recycling, treatment, and disposal of products containing hazardous materials. Liability under environmental laws and regulations can be joint and several and without regard to fault or negligence. For example, under certain circumstances and under certain environmental laws, we could be held liable for costs relating to contamination at our or our predecessors' past or present facilities and at third-party waste disposal sites. We could also be held liable for damages arising out of human exposure to hazardous materials. There can be no assurance that violations of environmental, health and safety laws will not occur as a result of human error, accident, equipment failure or other causes. The failure to comply with past, present or future laws could result in the imposition of substantial fines and penalties, remediation costs, property damage and personal injury claims, investigations, the suspension of production or product sales, loss of permits or a cessation of operations. Any of these events could harm our business, operating results, and financial condition. We also expect that our operations will be affected by new environmental, health and safety laws and regulations on an ongoing basis, or more stringent enforcement of existing laws and regulations. New laws or changes to existing laws may result in additional costs and may increase penalties associated with violations or require us to change the content of our products or how we manufacture them, which could have a material adverse effect on our business, operating results, and financial condition.

Ethical, legal, privacy, data protection and social concerns or governmental restrictions surrounding the use of genetic information could reduce demand for our technology.

Our products may be used to provide genetic information about humans, agricultural crops and other living organisms. The information obtained from our products could be used in a variety of applications which may have underlying ethical, legal, privacy, data protection and social concerns, including the genetic engineering or modification of agricultural products or testing for genetic predisposition for certain medical conditions. Governmental authorities could, for safety, social or other purposes, call for limits on or regulation of the use of genetic testing, and may consider or adopt such regulations or other restrictions. Such concerns or governmental restrictions could limit the use of our products or be costly and burdensome to comply with, and actual or perceived violations of any such restrictions may lead to the imposition of substantial fines and penalties, remediation costs, claims and litigation, regulatory investigations and proceedings, and other liability, any of which could have a material adverse effect on our business, financial condition, and results of operations.

Regulations related to conflict minerals has caused us to incur, and will continue to cause us to incur, additional expenses and could limit the supply and increase the costs of certain materials used in the manufacture of our products.

We are subject to requirements under the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 that require us to conduct diligence and report on whether or not our products contain conflict minerals. The implementation of these requirements could adversely affect the sourcing, availability and pricing of the materials used in the manufacture of components used in our products. Furthermore, the complex nature of our products requires components and materials that may be available only from a limited number of sources and, in some cases, from only a single source. We have incurred, and will continue to incur, additional costs to comply with the disclosure requirements, including costs related to conducting diligence procedures to determine the sources of conflict minerals that may be used or necessary to the production of our products and, if applicable, potential changes to components, processes, or sources of supply as a consequence of such verification activities. We may face reputational harm if we determine that certain of our products contain minerals that are not determined to be conflict free or if we are unable to alter our processes or sources of supply to avoid using such materials. In such circumstances, the reputational harm could materially and adversely affect our business, financial condition, or results of operations.

Risks Related to Owning Our Common Stock

The price of our common stock has been, is, and may continue to be, highly volatile, and you may be unable to sell your shares at or above the price you paid to acquire them.

The market price of our common stock is highly volatile, and we expect it to continue to be volatile for the foreseeable future in response to many risk factors listed in this section, and others beyond our control, including:

- actual or anticipated fluctuations in our financial condition and operating results;
- announcements of new products, technological innovations or strategic partnerships by us or our competitors;
- announcements by us, our customers, partners, or suppliers relating directly or indirectly to our products, services or technologies;
- overall conditions in our industry and market;
- addition or loss of 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, capital commitments or achievement of significant milestones;
- additions or departures of key personnel;
- 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 or 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;

- stock price and volume fluctuations attributable to inconsistent trading volume levels of our shares;
- reports, guidance and ratings issued by securities or industry analysts;
- operating results below the expectations of securities analysts or investors; and
- general economic and market conditions, which could be impacted by various events including COVID-19 or interest rate fluctuations, increases in fuel prices, foreign currency fluctuations, international tariffs, acts of terrorism, hostilities or the perception that hostilities may be imminent, military conflict and acts of war, including further political uncertainty and military actions associated with the war in Ukraine and the related response, including sanctions or other restrictive actions, by the United States and/or other countries.

If any of the forgoing occurs, it would cause our stock price or trading volume to decline. Stock markets in general and the market for companies in our industry in particular have experienced price and volume fluctuations, which have been exacerbated by the COVID-19 pandemic, and current macroeconomic trends and geopolitical events, and 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 and industry fluctuations, as well as general economic, political and market conditions such as recessions, interest rate changes or international currency fluctuations, may negatively impact the market price of our common stock. You may not realize any return on your investment in us and may lose some or all of your investment. In the past, companies that have experienced volatility in the market price of their stock have been subject to securities class action litigation. We have been a party to this type of litigation in the past and may be the target of this type of litigation again in the future. Securities litigation against us could result in substantial costs and divert our management's attention from other business concerns, which could seriously harm our business.

Sales of substantial amounts of our common stock in the public markets, or the perception that such sales might occur, could reduce the market price that our common stock might otherwise attain and may dilute your voting power and your ownership interest in us.

Sales of a substantial number of shares of our common stock in the public market, or the perception that such sales could occur, could adversely affect the market price of our common stock and may make it more difficult for existing stockholders to sell their common stock at a time and price that they deem appropriate and may dilute their voting power and ownership interest in us.

In addition, if our existing stockholders sell, or indicate an intent to sell, a large number of shares of our common stock in the public market, it could cause our stock price to fall. We may also issue shares of common stock or securities convertible into our common stock in connection with a financing, acquisition, our equity incentive plans, or otherwise. Any such issuances would result in dilution to our existing stockholders and the market price of our common stock may be adversely affected.

In September 2021, in connection with the closing of the Omniome Merger, we completed a private placement of an aggregate of 11,214,953 shares of our common stock, at a price of $26.75 per share, for aggregate gross proceeds of approximately $300 million (the "Private Placement") and registered the Private Placement shares for resale on a registration statement on Form S-3. The Private Placement Investors may sell any or all of their shares pursuant to the registration statement from time to time.

On January 27, 2023, we issued and sold an aggregate of 20,125,000 shares of our common stock at a purchase price of $10.00 per share pursuant to an automatic shelf registration statement filed on Form S-3 (File No. 333-249999) with the Securities and Exchange Commission, resulting in aggregate gross proceeds of approximately $201.3 million. The investors may sell any or all of their shares from time to time.

Concentration of ownership by our principal stockholders may result in control by such stockholders of the composition of our board of directors.

Our existing principal stockholders, executive officers, directors, and their affiliates beneficially own a significant number of our outstanding shares of common stock. In addition, such parties may acquire additional control by purchasing stock that we issue in connection with our future fundraising efforts. These parties may now and in the future be able to exercise a significant level of control over all matters requiring stockholder approval, including the election of directors. This control could have the effect of delaying or preventing a change of control of our company or changes in management and will make the approval of certain transactions difficult or impossible without the support of these stockholders.

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

Provisions in our amended and restated certificate of incorporation and amended and restated bylaws may have the effect of delaying or preventing a change of control or changes in our management. Our amended and restated certificate of incorporation and amended and restated bylaws include provisions that:

- authorize our board of directors to issue, without further action by the stockholders, up to 50,000,000 shares of undesignated preferred stock and up to approximately 1,000,000,000 shares of authorized but unissued shares of common stock;
- require that any action to be taken by our stockholders be effected at a duly called annual or special meeting and not by written consent;
- specify that special meetings of our stockholders can be called only by our board of directors, the Chair of the Board, the Chief Executive Officer or the President;
- establish advance notice procedures for stockholder approvals to be brought before an annual meeting of our stockholders, including proposed nominations of persons for election to our board of directors;
- establish that our board of directors is divided into three classes, Class I, Class II and Class III, with each class serving staggered terms;
- provide that our directors may be removed only for cause; and
- provide 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.

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, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which limits the ability of stockholders owning in excess of 15% of our outstanding voting stock to merge or combine with us.

Our amended and restated bylaws designate a state or federal court located within the State of Delaware as the exclusive forum for certain stockholder litigation matters, and also provide that the federal district courts will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act of 1933, as amended, each of which could limit our stockholders' ability to choose the judicial forum for disputes with us or our directors, officers, stockholders, or employees.

Our amended and restated bylaws provide that unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware (or, if the Court of Chancery does not have jurisdiction, another State court in Delaware or the federal district court for the District of Delaware) will, to the fullest extent permitted by law, be the sole and exclusive forum for: (i) any derivative action or proceeding brought on our behalf; (ii) any action asserting a claim of breach of a fiduciary duty owed by any of our current or former directors, stockholders, officers, or other employees to us or our stockholders; (iii) any action arising pursuant to any provision of the Delaware General Corporation Law; (iv) any action to interpret, apply, enforce or determine the validity of our amended and restated certificate of incorporation or our amended and restated bylaws; or (v) any action asserting a claim governed by the internal affairs doctrine, except as to each of (i) through (v) above, for any claim as to which such court determines that there is an indispensable party not subject to the jurisdiction of such court.

Section 22 of the Securities Act creates concurrent jurisdiction for federal and state courts over all such Securities Act actions. Accordingly, both state and federal courts have jurisdiction to entertain such claims. To prevent having to litigate claims in multiple jurisdictions and the threat of inconsistent or contrary rulings by different courts, among other considerations, our amended and restated bylaws also provide that, unless we consent in writing to the selection of an alternative forum, the federal district courts of the United States of America will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act including, without limitation and for the avoidance of doubt, any auditor, underwriter, expert, control person or other defendant.

Any person or entity purchasing, holding or otherwise acquiring any interest in any of our securities shall be deemed to have notice of and consented to the foregoing bylaw provisions. Although we believe these exclusive forum provisions benefit us by providing increased consistency in the application of Delaware law and federal securities laws in the types of lawsuits to which each applies, the exclusive forum provisions may limit a stockholder's ability to bring a claim in a judicial forum of its choosing for disputes with us or any of our directors, stockholders, officers or other employees, which may discourage lawsuits with respect to such claims against us and our current and former directors, stockholders, officers or other employees. In addition, a stockholder that is unable to bring a claim in the judicial forum of its choosing may be required to incur additional costs in the pursuit of actions which are subject to the exclusive forum provisions described above. Our stockholders will not be deemed to have waived our compliance with the federal securities laws and the rules and regulations thereunder as a result of our exclusive forum provisions. Further, in the event a court finds either exclusive forum provision contained in our bylaws to be unenforceable or inapplicable in an action, we may incur additional costs associated with resolving such action in other jurisdictions, which could harm our results of operations.

Our large number of authorized but unissued shares of common stock may potentially dilute existing stockholders' stockholdings.

We have a significant number of authorized but unissued shares of common stock. Our board of directors may issue shares of common stock from this authorized but unissued pool from time to time without stockholder approval, resulting in the dilution of our existing stockholders.

We do not intend to pay dividends for the foreseeable future.

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 price appreciation, which may never occur, as the only way to realize any future gains on their investments.

Risks Related to Our Notes

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

In February 2021, we issued $900.0 million in aggregate principal amount of 1.50% Convertible Senior Notes due 2028, which we refer to as the Notes. The Notes will mature on February 15, 2028, subject to earlier conversion, redemption or repurchase, including upon a fundamental change. Holders of the Notes will have the right to require us to repurchase all or a portion of their Notes upon the occurrence of a fundamental change before the maturity date at a repurchase price equal to 100% of the principal amount of the Notes to be repurchased, plus unpaid interest to, but excluding, the maturity date. In addition, upon conversion of the Notes, unless we elect to deliver solely shares of our common stock to settle such conversion (other than paying cash in lieu of delivering any fractional share), we will be required to settle a portion or all of our conversion obligation in cash in respect of the Notes being converted. Moreover, we will be required to repay the Notes in cash at their maturity unless earlier converted, redeemed, or repurchased. However, we may not have enough available cash or be able to obtain financing at the time we are required to make repurchases of Notes surrendered therefor or pay cash with respect to Notes being converted or at their maturity.

In addition, our ability to repurchase Notes or to pay cash upon conversions of Notes or at their maturity may be limited by law, regulatory authority or agreements governing our future indebtedness. Our failure to repurchase Notes at a time when the repurchase is required by the indenture or to pay cash upon conversions of Notes or at their maturity as required by the indenture would constitute a default under the indenture. A default under the indenture or the fundamental change itself could also lead to a default under agreements governing our future indebtedness. Moreover, the occurrence of a fundamental change under the indenture could constitute an event of default under any such agreement. If the payment of the related indebtedness were to be accelerated after any applicable notice or grace periods, we may not have sufficient funds to repay the indebtedness or to pay cash amounts due upon conversion, upon required repurchase or at maturity of the Notes.

If the Notes are converted, it may adversely affect our financial condition and operating results.

Holders of the Notes are entitled to convert their Notes at any time at their option. If one or more holders elect to convert their Notes, unless we elect to satisfy our conversion obligation by delivering solely shares of our common stock (other than paying cash in lieu of delivering any fractional share), we would be required to settle a portion or all of our conversion obligation in cash, which could adversely affect our liquidity.

General Risk Factors

Unfavorable global economic or political conditions could adversely affect our business, financial condition or results of operations.

General conditions in the global economy and in the global financial markets could adversely affect our results of operations, including the potential effects from the ongoing COVID-19 pandemic as discussed above, and the overall demand for nucleic acid sequencing products may be particularly vulnerable to unfavorable economic conditions. A global financial crisis, inflation or a global or regional political disruption, as well as acts of terrorism, hostilities, military conflict and acts of war, including any further political uncertainty and military actions associated with the war in Ukraine and the related response, could cause extreme volatility in the capital and credit markets. A severe or prolonged economic downturn or political disruption could result in a variety of risks to our business, including weakened demand for our products and our ability to raise additional capital when needed on acceptable terms, if at all. A weak or declining economy or political disruption could also strain our manufacturers or suppliers, possibly resulting in supply disruption, or cause our customers to delay making payments for our product and services. An impairment in value of our tangible or intangible assets could also be recorded as a result of weaker economic conditions. Any of the foregoing could harm our business and we cannot anticipate all of the ways in which the political or economic climate and financial market conditions could adversely impact our business.

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. Any failure to deliver products to our customers in a safe and timely 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 carriers are unable to deliver our products, the delivery 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 safe and 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.

We currently conduct operations in various countries and jurisdictions, and continue to expand to new international jurisdictions as part of our growth strategy and have experienced an increasing concentration of sales in certain regions outside the U.S. We sell directly and through distribution partners throughout Europe, the Asia-Pacific region, Mexico, Brazil, and South Africa and have a significant portion of our sales and customer support personnel in Europe and the Asia-Pacific region. As a result, we or our distribution partners may be subject to additional regulations and increased diversion of management time and efforts. 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 materially and adversely affected and failure to comply with laws and regulations applicable to business operations in foreign jurisdictions may also subject us to significant liabilities and other penalties. International operations entail a variety of other risks, including, without limitation:

- limits to travel as a result of the COVID-19 pandemic or other epidemics;
- challenges in staffing and managing foreign operations;
- potentially longer sales cycles and more time required to engage and educate customers on the benefits of our platform outside of the United States;
- the potential need for localized software and documentation;
- reduced protection for intellectual property rights in some countries and practical difficulties of enforcing intellectual property and contract rights abroad;
- defending against intellectual property claims in other countries;
- restrictions on both inbound and outbound cross-border investment, including enhanced oversight by the Committee on Foreign Investment in the United States (“CFIUS”) and substantial restrictions on investment from China;
- U.S. and foreign government trade restrictions, including those which may impose restrictions on the importation, exportation, re-exportation, sale, shipment or other transfer of programming, technology, components, and/or services to foreign persons;
- changes in diplomatic and trade relationships, including new tariffs, trade protection measures, import or export licensing requirements, trade embargoes, sanctions, and other trade barriers;
- tariffs imposed by the U.S. on goods from other countries and tariffs imposed by other countries on U.S. goods, including the tariffs by the U.S. government on various imports from China, Canada, Mexico, and the European Union (“E.U.”) and by the governments of these jurisdictions on certain U.S. goods, and any other possible tariffs that may be imposed on products such as ours, the scope and duration of which, if implemented, remains uncertain;
- deterioration of political relations between the U.S. and Russia, China, Japan, Korea, Canada, the United Kingdom (“U.K.”), and the E.U., which could have a material adverse effect on our sales and operations in these countries;
- changes in social, political, and economic conditions or in laws, regulations and policies governing foreign trade, manufacturing, development, and investment both domestically as well as in the other countries and jurisdictions into which we sell our products, including as a result of the withdrawal of the U.K. from the E.U.;
- difficulties in obtaining export licenses or in overcoming other trade barriers and restrictions resulting in delivery delays;
- fluctuations in currency exchange rates and the related effect on our results of operations;
- increased financial accounting and reporting burdens and complexities;
- disruptions to global trade due to disease outbreaks or conflicts;
- potential increases on tariffs or restrictions on trade generally; and

- significant taxes or other burdens of complying with a variety of foreign laws and regulations, including laws and regulations relating to privacy and data protection such as the E.U. General Data Protection Regulation which took effect in the E.U. in 2018.

In conducting our international operations, we are subject to U.S. laws relating to our international activities, such as the Foreign Corrupt Practices Act of 1977, as well as foreign laws relating to our activities in other countries, such as the United Kingdom Bribery Act of 2010. Additionally, the inclusion of one of our foreign customers on any U.S. Government sanctioned persons list, including but not limited to the U.S. Department of Commerce's List of Denied Persons and the U.S. Department of Treasury's List of Specially Designated Nationals and Blocked Persons List, could be material to our earnings. Failure to comply with these laws may subject us to claims or financial and/or other penalties in the United States and/or foreign countries that could materially and adversely impact our operations or financial condition. These risks have become increasingly prevalent as we have expanded our sales into countries that are generally recognized as having a higher risk of corruption.

We face risks related to the current global economic environment, which could delay or prevent our customers from purchasing our products, which could in turn harm our business, financial condition, and results of operations. The state of the global economy continues to be uncertain. The current global economic conditions and uncertain credit markets and concerns regarding the availability of credit pose a risk that could impact customer demand for our products, as well as our ability to manage normal commercial relationships with our customers, suppliers, and creditors, including financial institutions. If the current global economic environment deteriorates, our business could be negatively affected.

Moreover, 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 currencies could make our products more expensive, impacting our ability to compete or as a result of financial or other instability in such locations which could result in decreased sales of our products. Our costs of materials from international suppliers may also increase 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. Such actions may materially and adversely impact our financial condition and results of operations.

Violations of complex foreign and U.S. laws and regulations could result in fines and penalties, criminal sanctions against us, our officers, or our employees, prohibitions on the conduct of our business and on our ability to offer our products and services in one or more countries, and could also materially affect our brand, our international growth efforts, our ability to attract and retain employees, our business, and our operating results. Even if we implement policies or procedures designed to ensure compliance with these laws and regulations, there can be no assurance that our distribution partners, our employees, contractors, or agents will not violate our policies and subject us to potential claims or penalties.

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 and our stock price.

Ensuring that we have adequate internal financial and accounting controls and procedures in place to produce accurate financial statements on a timely basis is a costly and time-consuming effort that needs to be evaluated frequently. We may in the future discover areas of our internal financial and accounting controls and procedures that need improvement. Operating as a public company requires sufficient resources within the accounting and finance functions in order to produce timely financial information, ensure the level of segregation of duties, and maintain adequate internal control over financial reporting customary for a U.S. public company.

Our management is responsible for establishing and maintaining adequate internal control over financial reporting to provide reasonable assurance regarding the reliability of our financial reporting and the preparation of financial statements for external purposes in accordance with U.S. GAAP. Our management does not expect that our internal control over financial reporting will prevent or detect all errors and all fraud. A control system, no matter how well designed and operated, can provide only reasonable, not absolute, assurance that the control system's objectives will be met. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that misstatements due to error or fraud will not occur or that all control issues and instances of fraud, if any, within our company will have been detected.

Pursuant to Section 404 of the Sarbanes-Oxley Act, we perform periodic evaluations of our internal control over financial reporting. While we have in the past performed this evaluation and concluded that our internal control over financial reporting was operating effectively, there can be no assurance that in the future material weaknesses or significant deficiencies will not exist or otherwise be discovered. In addition, if we are unable to produce accurate financial statements on a timely basis, investors could lose confidence in the reliability of our financial statements, which could cause the market price of our common stock to decline and make it more difficult for us to finance our operations and growth.

Our business could be negatively impacted by changes in the United States political environment.

There is significant ongoing uncertainty with respect to potential legislation, regulation and government policy at the federal level, as well as the state and local levels. Any such changes could significantly impact our business as well as the markets in which we compete. Specific legislative and regulatory proposals discussed during election campaigns and more recently that might materially impact us include, but are not limited to, changes to spending priorities and potential reductions in research funding. Uncertainty about U.S. government funding has posed, and may continue to pose, a risk as customers may choose to postpone or reduce spending in response to actual or anticipated restraints on funding. To the extent changes in the political environment have a negative impact on us or on our markets, our business, results of operation and financial condition could be materially and adversely impacted in the future.

Disruption of critical information technology systems or material breaches in the security of our systems could harm our business, customer relations and financial condition.

Information technology ("IT") helps us to operate efficiently, interface with customers, maintain financial accuracy and efficiently and accurately produce our financial statements. IT systems are used extensively in virtually all aspects of our business, including sales forecast, order fulfillment and billing, customer service, logistics, and management of data from running samples on our products. Our success depends, in part, on the continued and uninterrupted performance of our IT systems. Our IT systems may be vulnerable to damage from a variety of sources, including telecommunications or network failures, power loss, natural disasters, human acts, computer viruses, ransomware, computer denial-of-service attacks, unauthorized access to customer or employee data or company trade secrets, and other attempts to harm our systems. Furthermore, there may be a heightened risk of potential cybersecurity incidents and security breaches to which we could be vulnerable by state-sponsored or affiliated actors or others in connection with the political uncertainty and military actions associated with the war in Ukraine. Certain of our systems are not redundant, and our disaster recovery planning is not sufficient for every eventuality. Despite any precautions we may take, such problems could result in, among other consequences, disruption of our operations, which could harm our reputation and financial results.

If we do not allocate and effectively manage the resources necessary to build and sustain the proper IT infrastructure, we could be subject to transaction errors, processing inefficiencies, loss of customers, business disruptions or loss of or damage to intellectual property. If our data management systems do not effectively collect, store, process and report relevant data for the operation of our business, whether due to equipment malfunction or constraints, software deficiencies or human error, our ability to effectively plan, forecast and execute our business plan and comply with applicable laws and regulations will be impaired, perhaps materially. Any such impairment could materially and adversely affect our reputation, financial condition, results of operations, cash flows and the timeliness with which we report our internal and external operating results.

Security breaches and other disruptions could compromise our information and expose us to liability, which would cause our business and reputation to suffer.

In the ordinary course of our business, we collect and store sensitive data, including intellectual property, our proprietary business information and that of our customers, suppliers and business partners, and personally identifiable information of our customers and employees, in our data centers and on our networks. The secure processing, maintenance and transmission of this information is critical to our operations. Despite our security measures, our IT infrastructure may be vulnerable to attacks by hackers, computer viruses, malicious codes, ransomware, unauthorized access attempts, and cyber- or phishing-attacks, or breached or otherwise disrupted due to employee error, malfeasance, faulty password management or other disruptions. Third parties may attempt to fraudulently induce employees or other persons into disclosing usernames, passwords or other sensitive information, which may in turn be used to access our IT systems, commit identity theft or carry out other unauthorized or illegal activities. Any such breach or incident could compromise our systems and networks and the information stored or otherwise processed there could be accessed, publicly disclosed, lost, stolen or otherwise processed in an unauthorized manner. We engage third-party vendors and service providers to store and otherwise process some of our data, including sensitive and personal information. Our vendors and service providers may also be the targets of the risks described above, including cyberattacks, malicious software, ransomware, phishing schemes, and fraud. Our ability to monitor our vendors and service providers' data security is limited, and, in any event, third parties may be able to circumvent those security measures, resulting in the unauthorized access to, misuse, disclosure, loss or destruction of our data, including sensitive and personal information, and disruption of our or third-party service providers' systems. We and our third-party service providers may face difficulties in identifying, or promptly responding to, potential security breaches and other instances of unauthorized access to, or disclosure or other loss or unavailability of, information. Any hacking or other attack on our or our third-party service providers' or vendors' systems, and any unauthorized access to, or disclosure or other loss of, information suffered by us or our third-party service providers or vendors, or the perception that any of these have occurred, could result in legal claims or proceedings, loss of intellectual property, liability under laws that protect the privacy of personal information, negative publicity, disruption of our operations and damage to our reputation, which could divert our management's attention from the operation of our business and materially and adversely affect our business, revenues and competitive position. Moreover, we may need to increase our efforts to train our personnel to detect and defend against cyber- or phishing-attacks, which are becoming more sophisticated and frequent, and we may need to implement additional

protective measures to reduce the risk of potential security breaches and security incidents, which could cause us to incur significant additional expenses. Retaliatory acts by Russia in response to Western sanctions or otherwise in connection with the war in Ukraine could include cyber attacks that could disrupt the economy generally or that may either directly or indirectly impact our operations specifically.

In addition, our insurance may be insufficient to cover our losses resulting from cyber-attacks, breaches, or other interruptions, and any incidents may result in loss of, or increased costs of, such insurance. The successful assertion of one or more large claims against us that exceed available insurance coverage, the occurrence of changes in our insurance policies, including premium increases or the imposition of large deductible or co-insurance requirements, or denials of coverage, could have a material adverse effect on our business, including our financial condition, results of operations and reputation.

We are currently subject to, and may in the future become subject to additional, U.S. federal and state laws and regulations imposing obligations on how we collect, store and process personal information. Our actual or perceived failure to comply with such obligations could harm our business. Ensuring compliance with such laws could also impair our efforts to maintain and expand our future customer base, and thereby decrease our revenue.

In the ordinary course of our business, we currently, and in the future will, collect, store, transfer, use or process sensitive data, including personally identifiable information of employees, and intellectual property and proprietary business information owned or controlled by ourselves and other parties. The secure processing, storage, maintenance, and transmission of this critical information are vital to our operations and business strategy. We are, and may increasingly become, subject to various laws and regulations, as well as contractual obligations, relating to data privacy and security in the jurisdictions in which we operate. The regulatory environment related to data privacy and security is increasingly rigorous, with new and constantly changing requirements applicable to our business, and enforcement practices are likely to remain uncertain for the foreseeable future. These laws and regulations may be interpreted and applied differently over time and from jurisdiction to jurisdiction, and it is possible that they will be interpreted and applied in ways that may have a material adverse effect on our business, financial condition, results of operations and prospects.

In the United States, various federal and state regulators, including governmental agencies like the Consumer Financial Protection Bureau and the Federal Trade Commission, have adopted, or are considering adopting, laws and regulations concerning personal information and data security. Certain state laws may be more stringent or broader in scope, or offer greater individual rights, with respect to personal information than federal, international or other state laws, and such laws may differ from each other, all of which may complicate compliance efforts. For example, the California Consumer Privacy Act ("CCPA"), which increases privacy rights for California residents and imposes obligations on companies that process their personal information, came into effect on January 1, 2020. Among other things, the CCPA requires covered companies to provide new disclosures to California consumers and provide such consumers new data protection and privacy rights, including the ability to opt-out of certain sales of personal information. The CCPA provides for civil penalties for violations, as well as a private right of action for certain data breaches that result in the loss of personal information. This private right of action may increase the likelihood of, and risks associated with, data breach litigation. In November 2020, California also passed the California Privacy Rights Act, or ("CPRA"), which significantly expands the CCPA as of January 1, 2023, including by introducing additional obligations such as data minimization and storage limitations and granting additional rights to consumers, among others. The enactment of the CCPA has prompted similar legislative developments in other states, such as Virginia, which in March 2021 enacted a Consumer Data Protection Act that is effective as of January 1, 2023, and Colorado, which in June 2021 enacted a Colorado Privacy Act that is effective as of July 1, 2023, Utah, which in March 2022 enacted a Utah Consumer Privacy Act that is effective as of July 1, 2023, and Connecticut, which in May 2022 enacted a similar law, An Act Concerning Personal Data Privacy and Online Monitoring, that is effective as of July 1, 2023. Similar laws are being considered by other state legislatures. In addition, laws in all 50 U.S. states require businesses to provide notice to consumers whose personal information has been disclosed as a result of a data breach. State laws are changing rapidly and there is discussion in the U.S. Congress of a new comprehensive federal data privacy law to which we would become subject if it is enacted. These and future laws and regulations may increase our compliance costs and potential liability.

Furthermore, regulations promulgated pursuant to the Health Insurance Portability and Accountability Act of 1996 ("HIPAA"), establish privacy and security standards that limit the use and disclosure of individually identifiable health information (known as "protected health information") and require the implementation of administrative, physical and technological safeguards to protect the privacy of protected health information and ensure the confidentiality, integrity and availability of electronic protected health information. Determining whether protected health information has been handled in compliance with applicable privacy standards and our contractual obligations can require complex factual and statistical analyses and may be subject to changing interpretation. Although we take measures to protect sensitive data from unauthorized access, use or disclosure, our information technology and infrastructure may be vulnerable to attacks by hackers or viruses or breached due to employee error, malfeasance or other malicious or inadvertent disruptions. Any such breach or interruption could compromise our networks and the information stored there could be accessed by unauthorized parties, manipulated, publicly disclosed, lost or stolen. Any such access, breach or other loss of information could result in legal claims or

proceedings, and liability under federal or state laws that protect the privacy of personal information, such as the HIPAA, the Health Information Technology for Economic and Clinical Health Act ("HITECH"), and regulatory penalties. Notice of breaches must be made to affected individuals, the Secretary of the Department of Health and Human Services, and for extensive breaches, notice may need to be made to the media or State Attorneys General. Such a notice could harm our reputation and our ability to compete.

While we have in place formal policies and procedures related to the storage, collection, and processing of information, and have conducted data privacy audits, we continue to evaluate our compliance needs, including the need to conduct additional internal and external data privacy audits or adopt additional policies and procedures, to ensure our compliance with all applicable data protection laws and regulations. Additionally, we do not currently have policies and procedures in place for assessing our third-party vendors' compliance with applicable data protection laws and regulations. All of these evolving compliance and operational requirements impose significant costs, such as costs related to organizational changes, implementing additional protection technologies, training employees and engaging consultants, which are likely to increase over time. In addition, such requirements may require us to modify our data processing practices and policies, distract management or divert resources from other initiatives and projects, all of which could have a material adverse effect on our business, financial condition, results of operations and prospects. Any failure or perceived failure by us or our third-party vendors, collaborators, contractors and consultants to comply with any applicable federal, state or similar foreign laws and regulations relating to data privacy and security, could result in damage to our reputation, as well as proceedings or litigation by governmental agencies or other third parties, including class action privacy litigation in certain jurisdictions, which would subject us to significant fines, sanctions, awards, penalties or judgments, all of which could have a material adverse effect on our business, financial condition, results of operations and prospects.

Increased scrutiny of our environmental, social or governance responsibilities may result in additional costs and risks, and may adversely impact our reputation, employee retention, and willingness of customers and suppliers to do business with us.

Investor advocacy groups, institutional investors, investment funds, proxy advisory services, stockholders, and customers are increasingly focused on environmental, social, and governance ("ESG") practices of companies. Additionally, public interest and legislative pressure related to public companies' ESG practices continues to grow. If our ESG practices fail to meet regulatory requirements or investor or other industry stakeholders' evolving expectations and standards for responsible corporate citizenship in areas including environmental stewardship, support for local communities, Board of Director and employee diversity, human capital management, employee health and safety practices, product quality, supply chain management, corporate governance and transparency, and employing ESG strategies in our operations, our brand, reputation and employee retention may be negatively impacted and customers and suppliers may be unwilling to do business with us. In addition, as we work to align our ESG practices with industry standards, we will likely continue to expand our disclosures in these areas and doing so may result in additional costs and require additional resources to monitor, report, and comply with our various ESG practices. If we fail to adopt ESG standards or practices as quickly as stakeholders desire, report on our ESG efforts or practices accurately, or satisfy the expectations of stakeholders, our reputation, business, financial performance, and growth may be adversely impacted.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

Our corporate headquarters, research and development facilities, and manufacturing and distribution centers are located in Menlo Park, California, where we lease approximately 180,200 square feet under a lease expiring on October 31, 2027. We operate additional research, development, and support functions in San Diego, where we lease approximately 73,500 square feet under a lease expiring on September 30, 2027. Additionally, our European headquarters is located in London, where we lease approximately 7,300 square feet under a lease expiring November 30, 2026. Including these leases, we lease approximately 275,000 square feet globally.

We believe that our existing facilities, together with suitable additional or alternative space available on commercially reasonable terms, will be sufficient to meet our needs.

ITEM 3. LEGAL PROCEEDINGS

U.S. District Court Proceedings

On September 26, 2019, Personal Genomics of Taiwan, Inc. ("PGI") filed a complaint in the U.S. District Court for the District of Delaware against us for patent infringement (C.A. No. 19-cv-1810) (the "PGI District Court matter"). The matter from this complaint is based on PGI's U.S. Patent No. 7,767,441 (the "'441 Patent"). We plan to vigorously defend in this matter. On November 20, 2019, we filed our answer to the complaint, denying infringement and seeking a declaratory judgement of invalidity of the '441 Patent.

On June 22, 2020, we filed a petition requesting institution of an inter-partes review ("IPR") to the Patent Trial and Appeals Board (the "Board") at the United States Patent Office requesting the Board to find a set of claims in the '441 Patent invalid. On June 27, 2020, we filed a second petition requesting institution of an IPR requesting the Board to find another set of claims in the '441 Patent invalid. The two petitions (the "PacBio IPR Petitions") requesting IPRs assert that all of the claims relevant to the PGI complaint are invalid. On January 19, 2021, the Board ordered that both PacBio IPR Petitions be instituted on all grounds presented. On January 18, 2022, the Board issued decisions on the two IPRs. In one IPR, all challenged claims were found unpatentable, including PGI's core device claims. In the second IPR, the Board did not find the disputed claims unpatentable. We are appealing the decision in the second IPR to the U.S. Court of Appeals for the Federal Circuit.

On August 19, 2020, the court ordered a stay of the PGI District Court matter based on a joint stipulation by the parties pending a final written decision on the IPRs. Following the final decision on the IPRs described above, on February 2, 2022, the judge ordered that the PGI District Court matter be reopened. However, in a subsequent order dated September 15, 2022, the judge stayed the PGI District Court matter pending a final decision by the U.S. Court of Appeals for the Federal Circuit regarding the appeal described above. We plan to vigorously defend against the remaining claims.

In December 2022, Take2 Technologies, Ltd. and the Chinese University of Hong Kong filed a complaint in the U.S. District Court for Delaware against us alleging infringement of U.S. Patent No. 11,091,794 (the "'794 Patent") (C.A. No. 22- cv-01595). The complaint alleges that our Sequel® II systems, Sequel IIe Systems, and Revio™ Systems that operate version 11.0 or later of the SMRT® Link software, infringe the '794 Patent. The complaint seeks unspecified monetary damages and an order enjoining us from infringing the '794 Patent. We filed a motion to dismiss on February 14, 2023. We believe the infringement allegations in the complaint lack merit and we intend to vigorously defend in this matter.

Proceedings in China

On May 12, 2020, PGI filed a complaint in the Wuhan Intermediate People's Court in China alleging infringement of one or more claims of China patent No. CN101743321B (the "CN321 Patent"), which is related to the '441 Patent. On November 23, 2020 we filed an Invalidation Petition at the China National Intellectual Property Administration (CNIPA) demonstrating the invalidity of the claims in the CN321 Patent on grounds of insufficient disclosure, and the lack of support, essential technical features, clarity, novelty, and inventiveness. A hearing in the invalidation proceeding at the CNIPA was held on April 29, 2021. On September 2, 2021, the CNIPA issued its decision on the Invalidation Petition and determined that all claims (1-61) of the CN321 patent were invalid. On December 1, 2021, PGI filed an appeal with the Beijing IP Court, contesting the CNIPA decision. We filed a petition with the Wuhan Intermediate People's court requesting dismissal of the infringement action based on the CNIPA invalidation decision, and PGI filed a petition to withdraw its complaint. The Wuhan Intermediate People's court granted PGI's petition and dismissed the infringement action in May 2022.

Other Proceedings

From time to time, we may also be involved in a variety of other claims, lawsuits, investigations, and proceedings relating to securities laws, product liability, patent infringement, contract disputes, employment, and other matters that arise in the normal course of our business. In addition, third parties may, from time to time, assert claims against us in the form of letters and other communications.

We record a provision for contingent losses when it is both probable that a liability has been incurred and the amount of the loss can be reasonably estimated. We currently do not believe that the ultimate outcome of any of the matters described above is probable or reasonably estimable, or that these matters will have a material adverse effect on our business; however, the results of litigation and claims are inherently unpredictable. Regardless of the outcome, litigation can have an adverse impact on us because of litigation and settlement costs, diversion of management resources, and other factors.

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

Our common stock is traded on The Nasdaq Global Select Market under the symbol "PACB."

Holders of Record

As of January 31, 2023, there were approximately 58 stockholders of record of our common stock, although we believe that there are a significantly larger number of beneficial owners of our common stock.

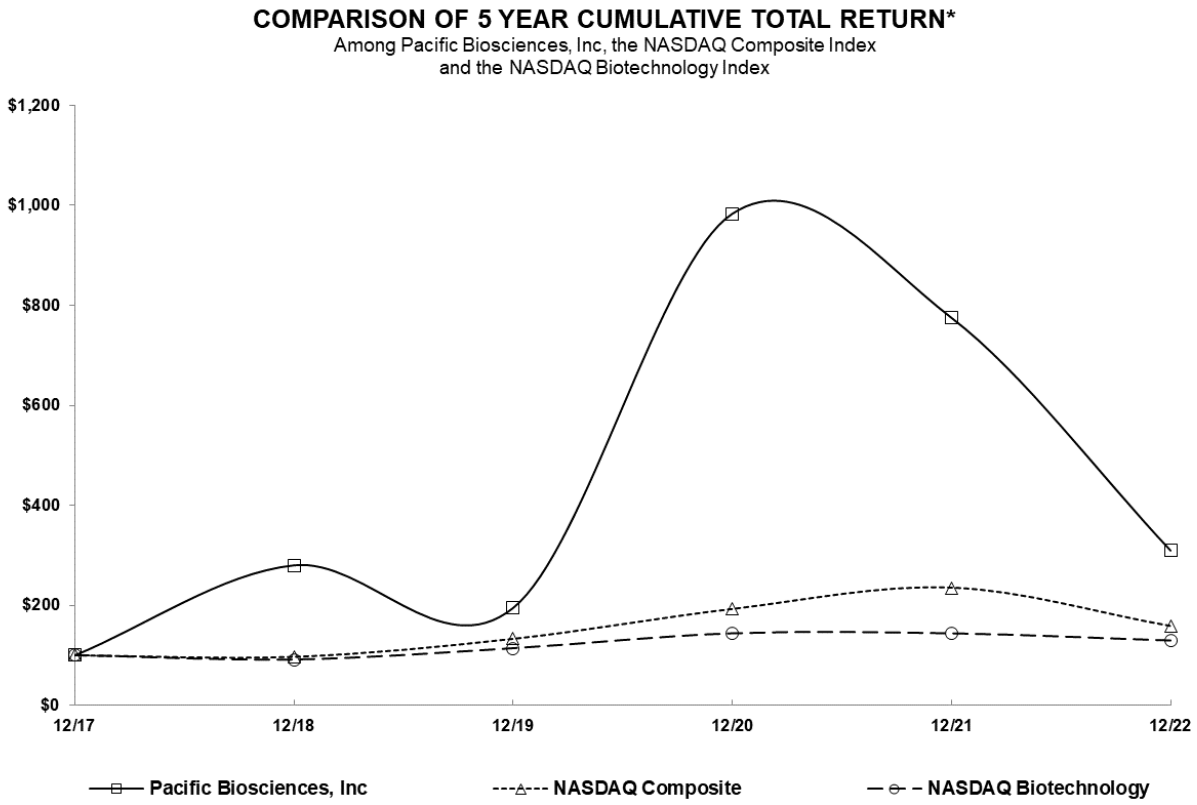
Dividend Policy

We have never declared or paid any cash dividend on our common stock and have no present plans to do so. We intend to retain earnings for use in the operation and expansion of our business.

Performance Graph

The performance graph included in this Annual Report on Form 10-K shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), or incorporated by reference into any filing of Pacific Biosciences under the Securities Act of 1933, as amended, or the Exchange Act, except as shall be expressly set forth by specific reference in such filing.

The following graph shows a comparison from December 31, 2017 through December 31, 2022 of the cumulative total return for our common stock, the Nasdaq Composite Index and the Nasdaq Biotechnology Index. Such returns are based on historical results and are not intended to suggest future performance. Data for The Nasdaq Composite Index and the Nasdaq Biotechnology Index assume reinvestment of dividends.



*$100 invested on 12/31/2017 in stock or index, including reinvestment of dividends.
Fiscal year ending December 31.

Recent Sales of Unregistered Securities

Not applicable.

ITEM 6. [Reserved]

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

You should read the following discussion and analysis of our financial condition and results of operations together with our consolidated financial statements and the related notes included in this Annual Report on Form 10-K. Some of the information contained in this discussion and analysis or set forth elsewhere in this Annual Report on Form 10-K, including information with respect to our plans and strategy for our business and related financing, includes forward-looking statements that involve risks and uncertainties. You should read the "Risk Factors" section of this Annual Report on Form 10-K for a discussion of important factors that could cause actual results to differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis.

Our Management's Discussion and Analysis (MD&A) is organized in the following sections:

- *Overview and Outlook*
- *Results of Operations*
- *Liquidity and Capital Resources*
- *Critical Accounting Policies and Estimates*
- *Quantitative and Qualitative Disclosure of Market Risk*
- *Recent Accounting Pronouncements*
- *Contractual Obligations*
- *Off Balance Sheet Arrangements*

Overview and Outlook

About PacBio

We are a premier life science technology company that is designing, developing, and manufacturing advanced sequencing solutions that enable scientists and clinical researchers to improve their understanding of the genome and ultimately, resolve genetically complex problems.

Our products and technology under development stem from two highly differentiated core technologies focused on accuracy, quality, and completeness, which include our existing HiFi long-read sequencing technology and our emerging Sequencing by Binding (SBB®) short-read sequencing technology. Our products address solutions across a broad set of research applications including human genomics, plant and animal sciences, infectious disease and microbiology, oncology, and other emerging applications.

Our focus is on providing our customers with advanced sequencing technologies with higher throughput and improved workflows that we believe will enable dramatic advancements in routine healthcare.

Our customers include academic and governmental research institutions, commercial testing and service laboratories, genome centers, public health labs, hospitals and clinical research institutes, contract research organizations (CROs), pharmaceutical companies, and agricultural companies.

As of December 31, 2022, our commercial team is comprised of approximately 195 employees, including 57 quota-carrying representatives, many with advanced degrees in biology and significant experience in the genomics industry.

Strategic Objectives

2022 was a productive year for us as we set out to transform the company, scale the business, and drive adoption for our advanced sequencing technologies.

Our 2023 strategic objectives are to:

- Drive rapid adoption of Revio™ by converting existing Sequel II/IIe customers and attracting new PacBio customers
- Demonstrate Onso's extraordinary level of accuracy in the field and show how it can transform research in needle-in-haystack applications
- Progress development of ultra-high-throughput and bench top long-read sequencers and next generation SBB short-read sequencer
- Leverage current infrastructure to drive toward positive cash flow
- Expand partnerships across ecosystem and workflow to drive customer adoption of SBB short-read sequencing and HiFi long-read sequencing

We will continue to leverage our commercial organization and make significant improvements in the efficiency and usability of our products to seek to reach a broader customer base. We believe the commercial investments we have recently made will further help drive growth in our business.

To increase the adoption of HiFi sequencing, we have various development programs in progress to expand our product portfolio as well as increase the throughput and improve the usability of our existing sequencing technologies. We continue to focus on programs to accelerate new platform launches in the near to mid-term as well as increase applications for our technologies. In October 2022, we announced Revio, our new HiFi long-read sequencing system. We began taking orders in the fourth quarter of 2022 and expect to commence commercial Revio shipments in March 2023. To address the oncology research markets with a highly differentiated alternative to existing third-party short-read sequencing products already on the market, we are also progressing development of Onso™, our SBB short-read platform. We began taking orders in January 2023 and remain on track for commercial shipment in the second quarter of 2023.

We continue to believe that with the capabilities of our HiFi chemistry and SMRT technology, we can be a market leader in whole-genome clinical sequencing. Leading institutions have adopted our products to study rare and inherited disease. We believe the market opportunity for clinical sequencing is significant and could drive substantial revenue growth for the company. We plan to continue to pursue partner collaborations where the technologies being developed or applications being considered extend beyond whole-genome clinical sequencing. Collaborative arrangements add to the awareness of our products and service offerings and may drive new applications for use of our technology.

Financial Overview

Broader macroeconomic dynamics including rising inflation, global supply chain constraints, volatile capital markets, competition, and lockdown restrictions associated with COVID-19 have adversely impacted our customers and lengthened customer sales cycles. Additionally, lock downs in China have led to lower than previously anticipated revenue in the Asia-Pacific region as customers had difficulty accessing labs and lower sample volumes from which to sequence. We expect some headwinds from a strengthening U.S. dollar, which impacts our revenue denominated in EUR and GBP but also impacts purchasing power of our customers in Asia as a stronger U.S. dollar makes buying our products more expensive.

Ongoing global supply chain constraints and rising inflation are also increasing our costs; as a result, we expect these costs to impact gross margins and cash flow. Due to the rising costs from global supply chain constraints and rising inflation, we are moderating our hiring with the aim of reducing our operating expense growth in 2023. We will continue to prioritize investments to develop and commercialize our new products, prioritizing opportunities that will generate a return over the near to mid-term.

The degree of further adverse impacts of COVID-19 on our business will depend on several factors, such as the duration and the extent of the pandemic, as well as actions taken by governments, businesses, and consumers in response to the pandemic, all of which continue to evolve and remain uncertain at this time.

The COVID-19 pandemic and efforts to control its spread have significantly curtailed the movement of people, goods, and services worldwide, including in the regions in which we sell our products and services and conduct our business operations. We have been negatively impacted by the COVID-19 pandemic and expect to continue to be impacted by COVID-19 for the foreseeable future. Due to the uncertain scope and duration of the pandemic, we cannot reasonably estimate the future impact to our operations and financial results.

The spread of COVID-19 caused us to modify our business practices, including limiting some of our commercial operations and limiting certain employees from working in the office. Starting in April 2022, we invited employees located near our reopened offices to return to the office.

See the *Risk Factors* section for further discussion of the possible impact of the COVID-19 pandemic on our business.

Key highlights of our 2022 consolidated financial results include the following:

- Revenue decreased $2.2 million, or 2%, to $128.3 million for the year ended December 31, 2022, as compared to $130.5 million for the year ended December 31, 2021. The decline was primarily caused by a decrease in instrument revenue, which was due in part to the robust demand for Revio, displacing previously anticipated Sequel IIe sales in the fourth quarter of 2022. We received orders in the fourth quarter of 2022 for 76 Revio systems with delivery in 2023. The decline in instrument revenue was partially offset by an increase in consumables revenue of $7.8 million.
- Gross profit as a percentage of revenue (gross margin) was 38.2% for the year ended December 31, 2022, compared to 45.1% for the year ended December 31, 2021. Gross margin declined due primarily to adjustments for excess inventory, either on hand or at our contract manufacturer, related to a faster than expected ramp in Revio demand, which resulted in a faster than expected decline in Sequel II/IIe demand upon the launch of Revio, as well as a decrease in instrument volume and higher overall product costs. Our gross margin in future periods will depend on several factors, including new product transitions, strategic product pricing; product mix; sales of higher-margin consumables; supply chain constraints and inflation increasing costs of raw materials; manufacturing capacity and production volumes impacting the cost of inventory; freight costs; and excess or obsolete inventories.
- Loss from operations increased $96.8 million or 46%, to $307.2 million for the year ended December 31, 2022, as compared to $210.4 million for the year ended December 31, 2021, driven primarily by an increase of $86.9 million of operating expenses, including a $80.1 million increase in research and development expenses, a $36.7 million increase in sales, general, and administrative expenses, and a $1.2 million increase in the change in the fair value of the contingent consideration, partially offset by a $31.1 million decrease in non-recurring merger-related costs incurred in 2021. See *Note 2. Business Acquisitions* for further details.
- Cash, cash equivalents, and short-term investments were $772.3 million at December 31, 2022, which represents a 26% decrease compared to the balance at December 31, 2021.

Recent Developments

Product Announcements

On October 25, 2022, we announced two new sequencing platforms, Revio and Onso.

Revio is a new long-read sequencing system designed to enable the use of HiFi sequencing for large studies in human genetics, cancer research, and agricultural genomics. We expect to commence commercial Revio shipments in March 2023.

Onso, a short-read DNA sequencing system, is designed to deliver industry-leading sensitivity and specificity for novel insights in oncology, disease research, and other applications. We commenced the beta program for Onso in the fourth quarter of 2022. We began taking orders for Onso during the first quarter of 2023 and remain on track for commercial shipment in the second quarter of 2023.

January 2023 Public Offering

On January 27, 2023, we issued and sold an aggregate of 20,125,000 shares of our common stock at a purchase price of $10.00 per share pursuant to an automatic shelf registration statement filed on Form S-3 (File No. 333-249999) with the Securities and Exchange Commission, resulting in aggregate gross proceeds of approximately $201.3 million.

Results of Operations

A detailed discussion of our consolidated financial results comparison between 2022 and 2021 is presented below. A discussion of the changes in our results of operations between the years ended December 31, 2021 and December 31, 2020, has been omitted from this Annual Report on Form 10-K but may be found in *Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations* of our *Annual Report on* Form 10-K for the year ended December 31, 2021, filed with the Securities and Exchange Commission on February 28, 2022, which is incorporated herein by reference, and which is available free of charge on the SEC's website at www.sec.gov and our corporate website (www.pacb.com).

Comparison of the Years Ended December 31, 2022 and 2021

(in thousands, except percentages)	Year Ended December 31, 2022	2021	$ Change	% Change
Revenue:				
Product revenue	$ 108,699	$ 113,505	$ (4,806)	(4%)
Service and other revenue	19,605	17,008	2,597	15%
Total revenue	128,304	130,513	(2,209)	(2%)
Cost of revenue:				
Cost of product revenue	60,932	56,358	4,574	8%
Cost of service and other revenue	13,899	14,989	(1,090)	(7%)
Amortization of intangible assets	733	306	427	140%
Loss on purchase commitment	3,705	—	3,705	100%
Total cost of revenue	79,269	71,653	7,616	11%
Gross profit	49,035	58,860	(9,825)	(17%)
Operating expense:				
Research and development	193,000	112,899	80,101	71%
Sales, general and administrative	160,854	124,124	36,730	30%
Merger-related expenses	—	31,129	(31,129)	(100%)
Change in fair value of contingent consideration	2,377	1,143	1,234	108%
Total operating expense	356,231	269,295	86,936	32%
Operating loss	(307,196)	(210,435)	(96,761)	(46%)
Loss from continuation advances from Illumina	—	(52,000)	52,000	100%
Interest expense	(14,690)	(12,530)	(2,160)	(17%)
Other income, net	7,638	93	7,545	8113%
Loss before benefit from income taxes	(314,248)	(274,872)	(39,376)	(14%)
Benefit from income taxes	—	(93,649)	93,649	100%
Net loss	$ (314,248)	$ (181,223)	$ (133,025)	(73%)

Revenue

The decrease in product revenue resulted primarily from a decrease of $12.6 million in instrument revenue, which was partially offset by an increase of $7.8 million in consumable revenue.

The decrease in instrument revenue was primarily due to fewer instruments sold. We believe this decrease was driven primarily by the anticipation of and robust demand for Revio, displacing previously anticipated Sequel IIe sales in 2022. At December 31, 2022, our installed base was 512 Sequel II and Sequel IIe systems compared to the 374 systems at December 31, 2021. We anticipate that sales volumes of Sequel II/IIe may decline as a result of the announcement of Revio and its anticipated availability for shipment in the first quarter of 2023. During the fourth quarter of 2022, we received orders for 76 Revio systems for delivery in 2023 and expect to see continued growth in Revio system sales, as well as the Onso system for which we began taking orders in January 2023.

The increase in consumable sales was primarily due to higher Sequel II/IIe consumables sales attributable to the growth in the instrument installed base. Consumable growth reflects approximately 24% growth in Sequel II and IIe SMRT cells shipped in 2022, as compared to 2021.

The increase in service and other revenue was primarily due to product services contracts sold on the growing installed base.

Cost of Revenue, Gross Profit, and Gross Margin

The increase in the cost of product revenue was driven primarily by adjustments for excess inventory primarily resulting from adjustments for excess inventory related to a faster than expected ramp in Revio demand, which resulted in a faster than expected decline in Sequel II/IIe demand upon the launch of Revio, as well as higher overall product costs.

The decrease in the cost of service and other revenue was primarily due to lower service personnel costs.

The loss on purchase commitment was $3.7 million for the year ended December 31, 2022. The purchase commitment loss is based on an estimate of future excess inventory related to a supply agreement with a third-party vendor, for which we do not expect to have related sales.

Gross profit decreased $9.8 million, or 17%. Gross margin was 38.2% for the year ended December 31, 2022 compared to 45.1% for the year ended December 31, 2021. The decrease in gross margin percentage was primarily due to adjustments for excess inventory, either on hand or at our contract manufacturer, related to a faster than expected ramp in Revio demand, which resulted in a faster than expected decline in Sequel II/IIe demand upon the launch of Revio, as well as a decrease in instrument sales volume and higher product costs, which was partially offset by consumables volumes and higher service and other revenues during the year ended December 31, 2022, compared to the year ended December 31, 2021.

We expect our gross margin will trend slightly lower during the first half of 2023, due in part to new product transitions and the impacts of inflation and increased supply chain costs. The global shortage of semiconductors continues to be a challenge for us in our supply chain and has resulted in cost increases that have and may continue to adversely impact margins. During these periods of shortages or delays, the price of components may increase, or the components may not be available at all. Additionally, in response to the surge in COVID-19 infections in 2022, the Chinese government-imposed lockdowns in certain parts of the country, which has had, and may continue to have, a negative impact on manufacturing and/or supply chains, as well as customer demand for our products and demand through certain distributors. We may not be able to secure enough components at reasonable prices or of acceptable quality to build new products in a timely manner in the quantities or configurations needed. Accordingly, our revenue and gross margins could suffer until other sources can be developed.

Research and Development Expense

The increase in research and development expense was primarily driven by an increase of $34.1 million in product development costs and an increase of $33.9 million in personnel expenses, including the acquired workforce from the Omniome acquisition. In addition, facilities and information technology related expenses associated with our research and development activities increased $9.9 million to support our operational expansion during the year ended December 31, 2022, compared to the year ended December 31, 2021. Research and development expense included share-based compensation expense of $30.7 million and $20.3 million during the twelve months ended December 31, 2022 and 2021, respectively.

We will continue to focus a significant portion of our resources on developing new products and solutions, including improving the efficiency and usability of existing products, developing new solutions, software, workflows and applications leveraging our core technologies. We anticipate that our spend will decline slightly in 2023 due to new product transitions. Additionally, we have collaborated and expect to continue to collaborate with strategic partners to develop sequencing solutions and expand the application of our technology.

Sales, General, and Administrative Expense

The increase in sales, general, and administrative expense was primarily driven by an increase of $13.0 million in personnel costs, $9.7 million in marketing expenses, including costs incurred in connection with product launches, $4.7 million in consulting and professional services, $4.2 million in travel-related expenses, and $2.7 million in facilities expenses and information technology related expenses. Sales, general, and administrative expense included share-based compensation expense of $43.1 million and $35.4 million during the twelve months ended December 31, 2022 and 2021, respectively. We anticipate sales, general, and administrative expense to continue to increase primarily as a result of the new product commercialization efforts.

Change in Fair Value of Contingent Consideration

The change in fair value of contingent consideration during the year ended December 31, 2022, represents the remeasurement impact of the contingent consideration of $200 million (composed of $100 million in cash and $100 million in shares of our common stock) that is due upon the achievement of a milestone, defined as the first commercial shipment to a customer of both an instrument and related consumables, utilizing SBB technology. The increase in contingent consideration liability was primarily due to the passage of time and changes in the probabilities of milestone achievement, offset by increases in the discount rate.

Loss from Continuation Advances from Illumina

As part of the Termination Agreement, Illumina paid us Continuation Advances totaling $52.0 million, which was repayable without interest to Illumina if, within two years of March 31, 2020, we entered into, or consummated a Change of Control

Transaction or raised at least $100 million in a single equity or debt financing (that may have multiple closings), with the amount repayable dependent on the amount raised by us.

Resulting from the issuance and sale of $900 million of 1.50% Convertible Senior Notes due February 15, 2028, $52.0 million of Continuation Advances were paid without interest to Illumina in February 2021 and recorded as other expense in the year ended December 31, 2021.

Interest Expense

The increase in interest expense for the year ended December 31, 2022, was primarily due to the twelve months of interest incurred on the $900 million of 1.50% Convertible Senior Notes due February 15, 2028, that we issued on February 16, 2021 during the year ended December 31, 2022 compared to only ten months of interest during the year ended December 31, 2021.

Other Income, Net

The increase in other income, net was primarily driven by a $8.4 million increase in interest income, partially offset by a $0.6 million increase in foreign exchange loss.

Benefit from Income Taxes

A deferred income tax benefit of $93.6 million for the year ended December 31, 2021, is related to the release of the valuation allowance for deferred tax assets due to the recognition of deferred tax liabilities in connection with the Omniome and Circulomics acquisitions. We maintain a full valuation allowance on the net deferred tax assets of our U.S. entities as we have concluded that it is more likely than not that we will not realize our deferred tax assets. Accordingly, this benefit from income taxes is reflected on our *Consolidated Statements of Operations and Comprehensive (Loss) Income* for the year ended December 31, 2021.

Liquidity and Capital Resources

Our primary sources of liquidity, other than our holdings of cash, cash equivalents, and investments, has primarily been through the issuance of debt or equity securities, together with cash flow from operating activities. For example, in January 2023, as discussed above, we issued and sold an aggregate of 20,125,000 shares of our common stock in a follow-on public offering for aggregate gross proceeds of approximately $201.3 million. We have historically incurred, and expect to continue to incur, operating losses and generate negative cash flows from operations on an annual basis due to the investments we intend to make as described in *Results of Operations* above, and as a result, we may require additional capital resources to execute our strategic initiatives to grow our business.

Cash, cash equivalents, and investments

As of December 31, 2022, we had $772.3 million in cash, cash equivalents, and investments, compared to $1.0 billion at December 31, 2021. The decrease was primarily attributable to $263.2 million cash used in operating activities for the twelve months ended December 31, 2022.

Convertible Senior Notes

At December 31, 2022, we had $900 million of principal Convertible Senior Notes outstanding resulting from our February 9, 2021, issuance of convertible notes due 2028 (the "Notes") with an aggregate principal of $900 million. The Notes bear interest at a rate of 1.50% per annum. Interest on the Notes is payable semi-annually in arrears on February 15 and August 15 commencing on August 15, 2021. The Notes will mature on February 15, 2028, subject to earlier conversion, redemption, or repurchase. The proceeds from the issuance of the convertible notes are being used to fund operations, strategic investments, and capital requirements.

The Notes are convertible at the option of the holder at any time until the second scheduled trading day prior to the maturity date, including in connection with a redemption by the Company. The Notes are convertible into shares of our common stock based on an initial conversion rate of 22.9885 shares of common stock per $1,000 principal amount of the Notes (which is equal to an initial conversion price of $43.50 per share), in each case subject to customary anti-dilution and other adjustments as a result of certain extraordinary transactions. Upon conversion of the Notes, we may elect to settle such conversion obligation in shares, cash or a combination of shares and cash.

With certain exceptions, upon a change of control of the Company or the failure of our common stock to be listed on certain stock exchanges, the holders of the Notes may require that we repurchase all or part of the principal amount of the Notes at a purchase price of par plus unpaid interest up to, but excluding, the maturity date.

The Indenture includes customary "events of default," which may result in the acceleration of the maturity of the Notes under the Indenture. The Indenture also includes customary covenants for convertible notes of this type.

See *Note 7. Convertible Senior Notes* for further details.

Additional Capital Requirements

We believe that our existing cash, cash equivalents, and investments will be sufficient to fund our projected operating and capital requirements for at least the next 12 months from the date of filing of this Annual Report on Form 10-K for the year ended December 31, 2022. Operating needs include planned costs to operate our business, including costs to fund working capital and capital expenditures. Recent and expected working and other capital requirements, in addition to the above matters, include:

- Our purchase orders and contractual obligations of approximately $145.7 million as of December 31, 2022, which consist of open purchase orders and contractual obligations in the ordinary course of business, including commitments with contract manufacturers and suppliers for which we have not received the goods or services. A majority of these purchase obligations are due within a year. Although open purchase orders are considered enforceable and legally binding, the terms generally allow us the option to cancel, reschedule and adjust our requirements based on our business needs prior to the delivery of goods or performance of services.
- As described in more detail in *Note 8 - Commitments and Contingencies* in the Notes to the Consolidated Financial Statements, we signed a Supply Agreement, which was amended in October 2022, with a supplier for the purchase of certain products over the period of 2023 through 2026. As part of the Supply Agreement, we made a $9.0 million deposit during the year ended December 31, 2022, and will pay an additional deposit of $6.0 million in 2023, to secure the supply of certain products through the term of the contract. If we breach the minimum volume purchase commitment during any applicable year, the supplier is entitled to retain a portion or all of the deposit corresponding to that year. If we terminate the Supply Agreement before January 15, 2027, Supplier will refund the remaining balance of the Deposit. If the supplier breaches its minimum volume supply commitment during any applicable year or portions thereof, our remedies include termination, pursuit of damages, or pursuit of specific performance. If, on or before October 31, 2024, we commit to purchasing a set amount of additional products during the calendar year 2026, Supplier will increase its maximum capacity guarantee to meet the additional demand. Should we exercise this option, we will be required to make an additional deposit of $5.0 million to Supplier within 30 days of the exercise.
- Our research and development expenditures of $193.0 million in 2022 and $112.9 million in 2021. While we expect to continue our investment in research and development in 2023, including enhancements of our existing products, and continued development of our Revio and Onso systems and other new technology and products, we expect research and development expenses to decline slightly in 2023 as compared to the year ended December 31, 2022 due to new product transitions.
- Cash outflows for capital expenditures of $16.8 million in 2022 and $5.9 million in 2021. We expect to continue to invest in capital expenditures in fiscal 2023 to continue to support manufacturing and expansion of our business, and anticipate a slight decline in 2023 as compared to the year ended December 31, 2022.
- Amounts related to future lease payments for operating lease obligations at December 31, 2022, totaling $58.6 million, with $12.0 million expected to be paid within the next 12 months.
- Amounts due under the term loan acquired in connection with Omniome at December 31, 2022, totaling $2.3 million, with $1.8 million expected to be paid within the next 12 months. Please see *Note 6. Balance Sheet Components* for additional information.
- Payments made to third party collaborators to help advance our technologies and the capabilities of our products. We may also choose to drive investments to help create an ecosystem of customers, partners, and collaborators whose expertise and offerings complement and enhance the capabilities and utility of our technology and increase genomic data available on our platforms.
- Payments related to licensing and other arrangements, which are cancelable license agreements with third parties for certain patent rights and technology. Under the terms of these agreements, we may be obligated to pay royalties based on revenue from the sales of licensed products, or minimum royalties, whichever is greater, and license maintenance fees. The future license maintenance fees and minimum royalty payments under the license agreements are not deemed to be material.

Our future capital requirements and the adequacy of our available funds will depend on many factors, including:

- our ability to successfully commercialize and develop products and solutions that address customer needs;
- the pace of adoption of our products and our ability to obtain new customers in markets;
- the progress of our research and development programs and our ability to initiate or expand research programs;
- our ability to manage manufacturing and production costs, including purchase obligations, and litigation costs, including the costs involved in preparing, filing, prosecuting, defending and enforcing intellectual property rights; and
- the extent to which we engage in collaborations with partners and acquire other businesses or technologies.

If economic, financial, business, or other factors adversely affect our ability to fund our projected operating cash requirements, we may be required to obtain funding through traditional or alternative sources of financing. We cannot be certain that funds will be available on favorable terms, or at all. If we are required and unable to raise additional capital when desired, our business, operating results, and financial condition may be adversely affected.

Cash Flow Summary

	Year Ended December 31,	
(in thousands)	2022	2021
Cash used in operating activities	$ (263,211)	$ (111,180)
Cash provided by (used in) investing activities	116,083	(678,531)
Cash provided by financing activities	9,622	1,169,581
Net (decrease) increase in cash, cash equivalents, and restricted cash	$ (137,506)	$ 379,870

Operating Activities

Our primary uses of cash in operating activities include the development of future products and product enhancements, manufacturing, and support functions related to our sales, general, and administrative activities.

Cash used in operating activities for the year ended December 31, 2022, of $263.2 million was due primarily to a $314.2 million net loss that was partially offset by non-cash items such as share-based compensation of $78.6 million, depreciation of $9.5 million, amortization of right-of-use assets of $6.9 million, inventory provision of $6.0 million, and a change in the estimated fair value of contingent consideration of $2.4 million. Cash flow impact from changes in net operating assets and liabilities of $54.0 million, was primarily attributable to increases of $33.9 million in inventory, net, $12.3 million in prepaid expenses and other assets, and decreases of $7.7 million in operating lease liabilities, $3.7 million in accrued expenses, and $3.7 million in deferred revenue, partially offset by a decrease of $5.5 million in accounts receivable, net, an increase of $1.0 million in accounts payable, and $0.9 million in other liabilities.

Cash used in operating activities for the year ended December 31, 2021, of $111.2 million was due primarily to a $181.2 million net loss, which includes a $93.6 million deferred income tax benefit, that was partially offset by a loss of $52.0 million from Continuation Advances repaid to Illumina that is considered a financing activity, non-cash items such as share-based compensation of $73.4 million, depreciation of $7.2 million, amortization of right-of-use assets of $4.0 million and a net cash inflow from changes in operating assets and liabilities of $20.3 million. Cash flow impact from changes in operating assets and liabilities was primarily attributable to increases of $25.7 million in deferred revenue, an increase of $15.3 million in accrued expenses and an increase of $6.4 million in accounts payable partially offset by an increase of $13.1 million in inventory, net, an increase of $7.2 million in accounts receivable, net, an increase of $1.0 million in prepaid expenses and other assets, and a decrease of $5.0 million in operating lease liabilities.

Investing Activities

Our investing activities consist primarily of capital expenditures and investment purchases and maturities. Cash used in investing activities for the year ended December 31, 2022, was due primarily to capital expenditures of $16.8 million and purchases of investments of $442.8 million offset by maturities of investments of $575.8 million.

Cash used in investing activities for the year ended December 31, 2021, was due primarily to net purchases of investments of $352.8 million, cash paid, net of cash acquired, of $319.8 million for the acquisitions of Omniome and Circulomics, and purchases of property and equipment of $5.9 million.

Financing Activities

Cash provided by financing activities during the year ended December 31, 2022, resulted from net proceeds of $11.2 million from the issuance of common stock through our equity compensation plans, partially offset by $1.6 million due to the payment of notes payable.

Cash provided by financing activities during the year ended December 31, 2021, resulted from net proceeds of $895.5 million from our February 2021 issuance of $900 million of 1.50% Convertible Senior Notes after deducting debt issuance costs, net proceeds of $294.8 million from our September 2021 private placement of common stock after deducting issuance costs and proceeds of $31.8 million from the issuance of common stock through our equity compensation plans, partially offset by $52.0 million of Continuation Advances repaid to Illumina.

Off-Balance Sheet Arrangements

As of December 31, 2022, we did not have any off-balance sheet arrangements.

In the ordinary course of business, we enter into standard indemnification arrangements. Pursuant to these arrangements, we indemnify, hold harmless, and agree to reimburse the indemnified parties for losses suffered or incurred by the indemnified party in connection with any trade secret, copyright, patent or other intellectual property infringement claim by any third party with respect to its technology, or from claims relating to our performance or non-performance under a contract,

any defective products supplied by us, or any acts or omissions, or willful misconduct, committed by us or any of our employees, agents or representatives. The term of these indemnification agreements is generally perpetual after the execution of the agreement. The maximum potential amount of future payments we could be required to make under these agreements is not determinable because it involves claims that may be made against us in future periods but have not yet been made. To date, we have not incurred costs to defend lawsuits or settle claims related to these indemnification agreements.

We also enter and have entered into indemnification agreements with our directors and officers that may require us to indemnify them against liabilities that arise by reason of their status or service as directors or officers, except as prohibited by applicable law. In addition, we may have obligations to hold harmless and indemnify third parties involved with our fundraising efforts and their respective affiliates, directors, officers, employees, agents or other representatives against any and all losses, claims, damages and liabilities related to claims arising against such parties pursuant to the terms of agreements entered into between us and such third parties in connection with such fundraising efforts. To the extent that such indemnification obligations apply to the lawsuits described in *Legal Proceedings* in Part I, Item 3 of this Annual Report on Form 10-K, any associated expenses incurred are included within the related accrued litigation expense amounts. No additional liability associated with such indemnification agreements has been recorded as of December 31, 2022.

Critical Accounting Policies and Estimates

Management's Discussion and Analysis of Financial Condition and Results of Operations is based upon our Consolidated Financial Statements, which we have prepared in accordance with U.S. GAAP. The preparation of these financial statements requires management to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenue, cost of revenue, and operating expenses, and related disclosure of contingent assets and liabilities. Management based its estimates on historical experience and on various other assumptions that it believes to be reasonable under the circumstances, the results of which form the basis for making judgements about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ materially from these estimates under different assumptions or conditions.

An accounting policy is deemed to be critical if it requires an accounting estimate to be made based on assumptions about matters that are highly uncertain at the time the estimate is made, if different estimates reasonably could have been used, or if changes in the estimate that are reasonably likely to occur could materially impact the financial statements.

Revenue Recognition

Our revenue is generated primarily from the sale of products and services. Product revenue primarily consists of sales of our instruments and related consumables; service and other revenue consist primarily of revenue earned from product maintenance agreements.

We account for a contract with a customer when there is a legally enforceable contract between us and the customer, the rights of the parties are identified, the contract has commercial substance, and collectability of the contract consideration is probable. Revenues are recognized when control of the promised goods, or services is transferred to our customers, or services are performed, in an amount that reflects the consideration we expect to be entitled to in exchange for those goods or services.

Our instrument sales are generally sold in a bundled arrangement and commonly include the instrument, instrument accessories, training, and consumables. For such bundled arrangements, we account for individual products and services separately if they are distinct, that is, if a product or service is separately identifiable from other items in the bundled package and if a customer can benefit from it on its own or with other resources that are readily available to the customer. Installation services are considered distinct from the instrument. Therefore, instrument revenue is recognized upon transfer of control of the asset to the customer, which is generally upon delivery for sales made to our non-distributor customers and upon shipment for sales made to our distributor customers.

The consideration for bundled arrangements is allocated between separate performance obligations based on their individual standalone selling price. We determine the best estimate of standalone selling price using average selling prices over a 12-month period combined with an assessment of current market conditions. If the standalone selling price is not directly observable, we rely on estimates by considering multiple factors including, but not limited to, overall market conditions, including geographic or regional specific factors, internal costs, profit objectives, pricing practices, and other observable inputs. We recognize revenues as performance obligations are satisfied by transferring control of the product or service to the customer or over the term of a product maintenance agreement with a customer. Our revenue arrangements generally do not provide a right of return.

Certain of our agreements provide options to customers which can be exercised at a future date, such as the option to purchase our product at discounted prices, among others. In accounting for customer options, we determine whether an option is a material right and this requires us to exercise significant judgment. If a contract provides the customer an option to acquire additional goods or services at a discount that exceeds the range of discounts that we typically give for that

product or service for the same class of customer, or if the option provides the customer certain additional goods or services for free, the option may be considered a material right. If the contract gives the customer the option to acquire additional goods or services at their normal standalone selling prices, we would likely determine that the option is not a material right and, therefore, account for it as a separate performance obligation when the customer exercises the option. If the standalone selling price of the option is not directly observable, an estimated standalone selling price is utilized which considers adjustments for discounts that the customer could receive without exercising the option and the likelihood that the option will be exercised. We may also utilize the alternative approach to estimate the standalone selling price, available pursuant to the applicable accounting guidance, to the extent we conclude the applicable criteria for using the alternative approach has been met. We update the transaction price for expected consideration, subject to constraint, each reporting period if our estimate of future goods to be ordered by customers change.

Inventories

Inventories are stated at the lower of cost or net realizable value. Cost is determined using the first-in, first-out ("FIFO") method. Adjustments to reduce the cost of inventory to its net realizable value, if required, are made for estimated excess or obsolete balances. Cost includes depreciation, labor, material, and overhead costs, including product and process technology costs while determining net realizable value of inventories involves numerous judgements, including projecting future average selling prices, sales volumes, and costs to complete products in work in process inventories.

We make inventory purchases and commitments to meet future shipment schedules based on forecasted demand for our products. The business environment in which we operate is subject to rapid changes in technology and customer demand. We perform a detailed assessment of inventory each period, which includes a review of, among other factors, demand requirements, product life cycle and development plans, component cost trends, product pricing, product expiration, and quality issues. Based on our analysis, we record adjustments to inventory for potentially excess, obsolete, or impaired goods, when appropriate, to report inventory at net realizable value. Inventory adjustments may be required if actual demand, component costs, supplier arrangements, or product life cycles differ from our estimates. Any such adjustments would result in a charge to our results of operations.

Business Combinations

Under the acquisition method of accounting, we allocate the fair value of the total consideration transferred to the tangible and identifiable intangible assets acquired and liabilities assumed based on their estimated fair values on the date of acquisition. The fair values assigned, defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between willing market participants, are based on estimates and assumptions determined by management. These valuations require us to make estimates and assumptions, especially with respect to intangible assets. We record the excess consideration over the aggregate fair value of tangible and intangible assets, net of liabilities assumed, as goodwill. Costs that we incur to complete the business combination, such as legal and other professional fees, are expensed as they are incurred.

In connection with certain acquisitions, contingent consideration can be earned by the sellers upon completion of certain future performance milestones. In these cases, a liability is recorded on the acquisition date for an estimate of the acquisition date fair value of the contingent consideration. Changes in the fair value of contingent consideration subsequent to the acquisition date are recognized in operating expenses in our consolidated statements of operations and comprehensive (loss) income.

We typically use the discounted cash flow method to value our acquired intangible assets. This method requires significant management judgment to forecast future operating results and utilizes significant assumptions such as assumed revenue growth rates, discount rates and obsolescence factors. The estimates we use to value and amortize intangible assets are consistent with the plans and estimates that we use to manage our business and are based on available historical information and industry estimates and averages. If the subsequent actual results and updated projections of the underlying business activity change compared with the assumptions and projections used to develop these values, we could experience impairment charges. In addition, we have estimated the economic lives of certain acquired assets and these lives are used to calculate depreciation and amortization expense. If our estimates of the economic lives change, depreciation or amortization expense could be accelerated or extended. We capitalize in-process research and development (IPR&D), which is considered indefinite lived until the completion or abandonment of the associated research and development efforts. Upon reaching the end of the relevant research and development project (i.e., upon commercialization), the IPR&D asset is amortized over its estimated useful life. If the relevant research and development project is abandoned, the IPR&D asset is expensed in the period of abandonment.

If the initial accounting for a business combination is incomplete by the end of a reporting period that falls within the measurement period, we report provisional amounts in our financial statements. During the measurement period, we adjust the provisional amounts recognized at the acquisition date to reflect new information obtained about facts and circumstances that existed as of the acquisition date that, if known, would have affected the measurement of the amounts recognized as of that date. We record these adjustments to the provisional amounts with a corresponding offset to goodwill. Any adjustments identified after the measurement period are recorded in the consolidated statements of income.

We acquired $11.4 million of finite-lived intangible assets, $400.0 million of IPR&D, and $410.0 million of goodwill in connection with the acquisitions of Omniome and Circulomics in the third quarter of 2021.

Goodwill and Intangible Assets with Indefinite Lives — Impairment Assessment

Goodwill and other intangible assets with indefinite useful lives (i.e., IPR&D) are not amortized, however they are tested annually for impairment, in the second and fourth quarter of our fiscal year, respectively, and whenever events or changes in circumstances indicate that it is more likely than not that the fair value is less than the carrying value. Events that would indicate impairment and trigger an interim impairment test include, but are not limited to, unexpected adverse business conditions, economic factors, unanticipated technological changes or competitive activities, loss of key personnel and acts by governments or courts.

We perform our goodwill impairment analysis at the reporting unit level. We have one reporting unit, which aligns with our reporting structure and availability of discrete financial information. During the goodwill impairment review, we assess qualitative factors to determine whether it is more likely than not that the fair value of our reporting unit is less than the carrying amount, including goodwill. The qualitative factors include, but are not limited to, macroeconomic conditions, industry and market considerations, and our overall financial performance. If, after assessing the totality of these qualitative factors, we determine that it is not more likely than not that the fair value of our reporting unit is less than the carrying amount, then no additional assessment is deemed necessary. Otherwise, we proceed to compare the estimated fair value of the reporting unit with the carrying value, including goodwill. If the carrying amount of the reporting unit exceeds the fair value, we record an impairment loss based on the difference. If a quantitative assessment is performed, the evaluation includes management estimates of cash flow projections based on internal future projections and/or use of a market approach by looking at market values of comparable companies. Key assumptions include, but are not limited to, revenue and operating income growth rates, discount rates and other factors. We consider peer revenues and earnings trading multiples from companies that have operational and financial characteristics that are similar to the asset under measurement and estimated weighted-average costs of capital. Different assumptions from those made in our analysis could materially affect projected cash flows and the evaluation of assets for impairment. We also consider our market capitalization as a part of our analysis. We may elect to bypass the qualitative assessment in a period and proceed to perform the quantitative goodwill impairment test.

During the IPR&D impairment review, we assess qualitative factors to determine whether it is more likely than not that the fair value of the IPR&D is less than the carrying amount. The qualitative factors include, but are not limited to, macroeconomic conditions, industry-specific conditions, and company-specific conditions. If, after assessing the totality of these qualitative factors, we determine that it is not more likely than not that the fair value of the IPR&D is less than the carrying amount, then no additional assessment is deemed necessary. Otherwise, we proceed to compare the estimated fair value of the IPR&D with the carrying value. If the carrying amount of the IPR&D exceeds the fair value, we record an impairment loss based on the difference. If a quantitative assessment is performed, the evaluation includes management estimates of cash flow projections based on internal future projections. Key assumptions include, but are not limited to, revenue and operating income growth rates, discount rates and other factors. We consider peer revenues and earnings trading multiples from companies that have operational and financial characteristics that are similar to the asset under measurement and estimated weighted-average costs of capital. Different assumptions from those made in our analysis could materially affect projected cash flows and the evaluation of assets for impairment. We may elect to bypass the qualitative assessment in a period and proceed to perform the quantitative impairment test.

Intangible Assets and Other Long-Lived Assets — Impairment Assessment

We perform regular reviews to determine if any event has occurred that may indicate that the carrying values of our intangible assets with finite lives and other long-lived assets are impaired. If indicators of impairment exist, we assess the recoverability of the affected assets by determining whether their carrying amounts exceed their undiscounted expected future cash flows. If the affected assets are not recoverable, we estimate the fair value of the assets and record an impairment loss if the carrying value exceeds the fair value. Factors that may indicate potential impairment include a significant decline in our stock price and market capitalization compared to net book value, significant changes in the ability of an asset to generate positive cash flows and the pattern of utilization of a particular asset.

In order to estimate the fair values of identifiable intangible assets with finite lives and other long-lived assets, we estimate the present value of future cash flows from those assets. The key assumptions that we use in our discounted cash flow model are the amount and timing of estimated future cash flows to be generated by the asset over an extended period of time and a rate of return that considers the relative risk of achieving the cash flows, the time value of money, and other factors that a willing market participant would consider. Significant judgment is required to estimate the amount and timing of future cash flows and the relative risk of achieving those cash flows.

Assumptions and estimates about future values and remaining useful lives are complex and often subjective. They can be affected by a variety of factors, including external factors such as industry and economic trends, and internal factors such as changes in our business strategy and our internal forecasts.

Contingent Consideration

In connection with the acquisition of Omniome in the third quarter of 2021, we entered into an arrangement where we are obligated to pay $200 million in cash and equity dependent upon the achievement of a milestone event upon the first commercial shipment of products developed from our acquired sequencing technology. See *Note 2. Business Acquisitions* for further information.

The contingent consideration liability was measured at fair value as of the acquisition date and is remeasured periodically at each reporting date, with changes in fair value recorded as change in fair value of contingent consideration in the statement of operations. The initial measurement and post-acquisition remeasurement require estimates and assumptions using a scenario-based method that considers a range of potential outcomes of milestone achievement dates and assigned probabilities of occurrence for each outcome. Outcomes are discounted to present value, which is then weighted by the probability of each scenario to determine the total fair value of the contingent consideration payment as of each reporting period. This method requires significant management judgment, including the probability of achieving certain future milestones and discount rates. Future changes in our estimates could result in expenses or gains. Refer to *Note 5. Financial Instruments* for further discussion on valuation assumptions.

Recent Accounting Pronouncements

Please see *Note 1. Organization and Significant Accounting Policies*, subsection titled “Recent Accounting Pronouncements”, in Part II, Item 8 of this Annual Report on Form 10-K for information regarding applicable recent accounting pronouncements.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Interest Rate and Market Risk

Our investment portfolio is exposed to market risk from changes in interest rates. The goals of our investment policy are preservation of capital, fulfillment of liquidity needs and fiduciary control of cash and cash equivalents and investments. We also seek to maximize income from our investments without assuming significant risk. To achieve our goals, we maintain a portfolio of cash equivalents and investments in a variety of securities of high credit quality. The securities in our investment portfolio are not leveraged, are classified as available for sale and are, due to their short-term nature, subject to minimal interest rate risk. The fair market value of our fixed rate securities may be adversely impacted by increases in interest rates while income earned may decline as a result of decreases in interest rates. A hypothetical 100 basis-point (one percentage point) increase or decrease in interest rates compared to rates on December 31, 2022 would have affected the fair value of our investment portfolio by approximately $2.5 million.

We carry our convertible senior notes at the principal amount, less unamortized debt issuance costs, on our Consolidated Balance Sheets. Because the notes have a fixed annual interest rate of 1.50%, we do not have any economic interest rate exposure or financial statement risk associated with changes in interest rates. The fair value of the notes, however, may fluctuate when interest rates and the market price of our stock changes. See *Note 7. Convertible Senior Notes* in Part II, Item 8 of this Annual Form 10-K for additional information.

Foreign Exchange Risk

Our revenue, expense, and capital purchasing activities are primarily transacted in U.S. dollars; however, a portion of our operations is conducted in foreign currencies. As a result, we have foreign exchange exposures relating to non-U.S. dollar denominated cash flows and monetary assets and liabilities that are denominated in currencies other than U.S. dollars. The value of the amounts is exposed to changes in currency exchange rates from the time the transactions are originated, until the time the cash settlement is converted into U.S. dollars. Our foreign currency exposure is primarily concentrated in the Euro. A 10% strengthening of the U.S. dollar exchange rate against all currencies with which we have exposure, after taking into account offsetting positions at December 31, 2022 would have resulted in a $1.3 million decrease in the carrying amounts of those net assets. Actual gains and losses in the future may differ materially from these hypothetical gains and losses based on changes in the timing and amount of foreign currency exchange rate movements and our actual exposure. Our international operations are subject to risks typical of international operations, including, but not limited to, differing economic conditions, changes in political climate, differing tax structures, other regulations and restrictions, and foreign exchange rate volatility.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

PACIFIC BIOSCIENCES OF CALIFORNIA, INC.
Index to Consolidated Financial Statements

Report of Independent Registered Public Accounting Firm

To the Stockholders and the Board of Directors of Pacific Biosciences of California, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Pacific Biosciences of California, Inc. (the Company) as of December 31, 2022 and 2021, the related consolidated statements of operations and comprehensive (loss) income**,** stockholders' equity and cash flows for each of the three years in the period ended December 31, 2022, and the related notes (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2022, in conformity with 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 December 31, 2022, 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 February 28, 2023, expressed an unqualified 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 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 matters below, providing a separate opinion on the critical audit matter or on the account or disclosure to which it relates.

Revenue recognition - Identification of performance obligations and allocation of contract consideration

Description of the Matter	For the year ended December 31, 2022, the Company recognized revenue of $128.3 million, including $108.7 million of product revenue, which consists primarily of instrument sales and related consumables. As described in Note 1 to the consolidated financial statements, instrument sales are generally sold in a bundled arrangement and commonly include the instrument, instrument accessories, training, and consumables. For bundled arrangements, the Company identifies a performance obligation for each promise to transfer, to the customer, a product or service that is distinct. The consideration for bundled arrangements is allocated between each performance obligation based on its individual standalone selling price, which is estimated by the Company, using historical sales data, as well as management judgment. The Company enters into, or periodically modifies, revenue contracts with non-standard terms, requiring management to evaluate whether these non-standard terms represent a performance obligation. For example, the Company may offer specified discounts on current components of the bundled arrangements and on future purchase options, for which historical information may not be available. As part of the Company's identification of performance obligations and the resulting determination of the allocation of contract consideration, the Company considers if these specified discounts represent a material right when compared to the estimated standalone selling price and, therefore, a performance obligation to be included in the allocation of the contract value. Auditing management's identification of the performance obligations and the resulting determination of the allocation of contract consideration in certain contracts involved a higher degree of judgment due to the subjective nature of identifying certain performance obligations and the related determination of standalone selling price when it is not based on historical information.
How We Addressed the Matter in Our Audit	We obtained an understanding, evaluated the design, and tested the operating effectiveness of the Company's internal controls addressing management's identification of performance obligations and allocation of contract consideration, including standalone selling price determination. Our audit procedures included, among others, reading executed contracts for a sample of arrangements and evaluating whether terms of the contracts (including specified discounts on current and future purchase options) resulted in additional performance obligations. Additionally, we tested the completeness and accuracy of the information used in management's allocation of contract consideration, including the data incorporated in underlying calculations to determine standalone selling price.

/s/ Ernst & Young LLP

We have served as the Company's auditor since 2011.

San Mateo, California

February 28, 2023

PACIFIC BIOSCIENCES OF CALIFORNIA, INC.

Consolidated Balance Sheets

(in thousands, except per share amounts)	December 31, 2022	December 31, 2021
Assets		
Current assets		
Cash and cash equivalents	$ 325,089	$ 460,725
Investments	447,229	583,675
Accounts receivable, net	18,786	24,241
Inventory, net	50,381	24,599
Prepaid expenses and other current assets	10,289	7,394
Short-term restricted cash	300	500
Total current assets	852,074	1,101,134
Property and equipment, net	41,580	32,504
Operating lease right-of-use assets, net	39,763	46,617
Long-term restricted cash	2,922	4,592
Intangible assets, net	410,245	410,979
Goodwill	409,974	409,974
Other long-term assets	10,528	1,170
Total assets	$ 1,767,086	$ 2,006,970
Liabilities and Stockholders' Equity		
Current liabilities		
Accounts payable	$ 12,028	$ 11,002
Accrued expenses	32,596	36,261
Deferred revenue, current	30,498	10,977
Operating lease liabilities, current	8,886	7,710
Other liabilities, current	7,233	5,759
Contingent consideration liability, current	172,094	—
Total current liabilities	263,335	71,709
Deferred revenue, non-current	1,794	25,049
Contingent consideration liability, non-current	—	169,717
Operating lease liabilities, non-current	41,070	49,970
Convertible senior notes, net, non-current	896,683	896,067
Other liabilities, non-current	1,300	3,471
Total liabilities	1,204,182	1,215,983
Commitments and contingencies		
Stockholders' equity		
Preferred stock, $0.001 par value:		
Authorized 50,000 shares; No shares issued or outstanding	—	—
Common stock, $0.001 par value:		
Authorized 1,000,000 shares; issued and outstanding 226,505 and 220,978 shares at December 31, 2022 and December 31, 2021, respectively	227	221
Additional paid-in capital	2,099,782	2,009,945
Accumulated other comprehensive loss	(4,765)	(1,087)
Accumulated deficit	(1,532,340)	(1,218,092)
Total stockholders' equity	562,904	790,987
Total liabilities and stockholders' equity	$ 1,767,086	$ 2,006,970

See accompanying notes to the consolidated financial statements.

PACIFIC BIOSCIENCES OF CALIFORNIA, INC.

Consolidated Statements of Operations and Comprehensive (Loss) Income

(in thousands, except per share amounts)	Years Ended December 31, 2022	2021	2020
Revenue:			
Product revenue	$ 108,699	$ 113,505	$ 65,424
Service and other revenue	19,605	17,008	13,469
Total revenue	128,304	130,513	78,893
Cost of Revenue:			
Cost of product revenue	60,932	56,358	35,424
Cost of service and other revenue	13,899	14,989	10,903
Amortization of intangible assets	733	306	—
Loss on purchase commitment	3,705	—	—
Total cost of revenue	79,269	71,653	46,327
Gross profit	49,035	58,860	32,566
Operating Expense:			
Research and development	193,000	112,899	64,152
Sales, general and administrative	160,854	124,124	72,799
Merger-related expenses	—	31,129	—
Change in fair value of contingent consideration	2,377	1,143	—
Total operating expense	356,231	269,295	136,951
Operating loss	(307,196)	(210,435)	(104,385)
Gain from Reverse Termination Fee from Illumina	—	—	98,000
(Loss)/Gain from Continuation Advances from Illumina	—	(52,000)	34,000
Interest expense	(14,690)	(12,530)	(267)
Other income, net	7,638	93	2,055
(Loss) income before benefit from income taxes	(314,248)	(274,872)	29,403
Benefit from income taxes	—	(93,649)	—
Net (loss) income	(314,248)	(181,223)	29,403
Other comprehensive (loss) income:			
Unrealized (loss) gain on investments	(3,678)	(1,172)	80
Comprehensive (loss) income	$ (317,926)	$ (182,395)	$ 29,483
Net (loss) income per share:			
Basic	$ (1.40)	$ (0.89)	$ 0.18
Diluted	$ (1.40)	$ (0.89)	$ 0.17
Weighted average shares outstanding used in calculating net (loss) income per share			
Basic	224,550	204,136	165,187
Diluted	224,550	204,136	174,970

See accompanying notes to the consolidated financial statements.

PACIFIC BIOSCIENCES OF CALIFORNIA, INC.

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
Balance at December 31, 2019	153,119	$ 153	$ 1,120,999	$ 5	$ (1,066,240)	$ 54,917
Net income	—	—	—	—	29,403	29,403
Other comprehensive gain	—	—	—	80	—	80
ASC 326 adoption effect	—	—	—	—	(32)	(32)
Issuance of common stock in conjunction with equity plans	9,819	10	46,350	—	—	46,360
Issuance of common stock from Underwritten Public Equity Offerings, net of issuance costs	29,356	29	187,201	—	—	187,230
Share-based compensation expense	—	—	17,533	—	—	17,533
Balance at December 31, 2020	192,294	$ 192	$ 1,372,083	$ 85	$ (1,036,869)	$ 335,491
Net loss	—	—	—	—	(181,223)	(181,223)
Other comprehensive loss	—	—	—	(1,172)	—	(1,172)
Issuance of common stock in conjunction with equity plans	8,557	9	31,797	—	—	31,806
Issuance of common stock in Private Placement, net of issuance costs	11,215	11	294,834	—	—	294,845
Issuance of common stock in acquisition of Omniome	8,912	9	237,876	—	—	237,885
Share-based compensation expense	—	—	73,355	—	—	73,355
Balance at December 31, 2021	220,978	$ 221	$ 2,009,945	$ (1,087)	$ (1,218,092)	$ 790,987
Net loss	—	—	—	—	(314,248)	(314,248)
Other comprehensive loss	—	—	—	(3,678)	—	(3,678)
Issuance of common stock in conjunction with equity plans	5,527	6	11,224	—	—	11,230
Share-based compensation expense	—	—	78,613	—	—	78,613
Balance at December 31, 2022	226,505	$ 227	$ 2,099,782	$ (4,765)	$ (1,532,340)	$ 562,904

See accompanying notes to the consolidated financial statements.

PACIFIC BIOSCIENCES OF CALIFORNIA, INC.

Consolidated Statements of Cash Flows

(in thousands)	Years Ended December 31, 2022	2021	2020
Cash flows from operating activities			
Net (loss) income	$ (314,248)	$ (181,223)	$ 29,403
Adjustments to reconcile net loss to net cash used in operating activities			
Loss (gain) from Continuation Advances	—	52,000	(34,000)
Depreciation	9,480	7,199	6,428
Amortization of intangibles	913	381	—
Amortization of right-of-use assets	6,925	4,005	2,876
Amortization of debt discount and financing costs	640	539	129
Share-based compensation	78,613	73,355	17,533
Amortization of premium and accretion of discount on marketable securities, net	(244)	4,011	(107)
Change in the estimated fair value of contingent consideration	2,377	1,143	—
Inventory provision	6,027	678	527
Loss on disposition of equipment	278	54	—
Deferred income taxes	—	(93,649)	—
Changes in assets and liabilities			
Accounts receivable, net	5,455	(7,166)	(1,603)
Inventory, net	(33,906)	(13,109)	(1,623)
Prepaid expenses and other assets	(12,324)	(1,024)	(1,063)
Accounts payable	1,025	6,363	(5,072)
Accrued expenses	(3,651)	15,320	4,102
Deferred revenue	(3,734)	25,736	729
Operating lease liabilities	(7,724)	(4,990)	(3,802)
Other liabilities	887	(803)	5,046
Net cash (used in) provided by operating activities	(263,211)	(111,180)	19,503
Cash flows from investing activities			
Purchase of property and equipment	(16,750)	(5,931)	(1,039)
Purchase of intangible assets	(179)	—	—
Cash paid for purchase of Circulomics, net of cash acquired	—	(28,560)	—
Cash paid for purchase of Omniome, net of cash acquired	—	(291,233)	—
Purchase of investments	(442,788)	(988,046)	(373,283)
Sales of investments	—	212,734	1,400
Maturities of investments	575,800	422,505	153,600
Net cash provided by (used in) in investing activities	116,083	(678,531)	(219,322)
Cash flows from financing activities			
Continuation Advances	—	(52,000)	34,000
Proceeds from issuance of Convertible Senior Notes, net of issuance costs	—	895,536	—
Proceeds from issuance of common stock under equity offerings, net of issuance costs	—	294,845	187,479
Proceeds from issuance of common stock from equity plans	11,230	31,806	46,360
Notes payable principal payoff	(1,608)	(361)	(16,000)
Other	—	(245)	—
Net cash provided by financing activities	9,622	1,169,581	251,839
Net (decrease) increase in cash, cash equivalents, and restricted cash	(137,506)	379,870	52,020
Cash, cash equivalents, and restricted cash at beginning of period	465,817	85,947	33,927
Cash, cash equivalents, and restricted cash at end of period	$ 328,311	$ 465,817	$ 85,947
Cash and cash equivalents at end of period	325,089	460,725	81,611
Restricted cash at end of period	3,222	5,092	4,336
Cash, cash equivalents, and restricted cash at end of period	$ 328,311	$ 465,817	$ 85,947
Supplemental disclosure of cash flow information			
Interest paid	$ 14,049	$ 6,928	$ 491
Supplemental disclosure of non-cash investing and financing activities			
Inventory transferred to property and equipment	$ 2,812	$ 2,586	$ 1,097
Property and equipment transferred to inventory	$ (715)	$ (383)	$ (919)
Right-of-use asset and liability additions and modifications	$ —	$ 2,576	$ —
Issuance of common stock in acquisition of Omniome	$ —	$ 237,885	$ —

See accompanying notes to the consolidated financial statements.

NOTE 1. ORGANIZATION AND SIGNIFICANT ACCOUNTING POLICIES

Business Overview

We are a life science technology company that is designing, developing, and manufacturing advanced sequencing solutions that enable scientists and clinical researchers to improve their understanding of the genome and ultimately, resolve genetically complex problems. Our products and technology under development stem from two highly differentiated core technologies focused on accuracy, quality, and completeness, which include our existing HiFi long-read sequencing technology and our emerging short-read Sequencing by Binding (SBB®) technology. Our products address solutions across a broad set of applications including human genomics, plant and animal sciences, infectious disease and microbiology, oncology, and other emerging applications. Our focus is on providing our customers with advanced sequencing technologies with higher throughput and improved workflows that we believe will enable dramatic advancements in routine healthcare. Our customers include academic and governmental research institutions, commercial testing and service laboratories, genome centers, public health labs, hospitals and clinical research institutes, contract research organizations (CROs), pharmaceutical companies, and agricultural companies.

References in this report to "PacBio," "we," "us," the "Company," and "our" refer to Pacific Biosciences of California, Inc. and its consolidated subsidiaries.

Basis of Presentation and Consolidation

Our consolidated financial statements have been prepared in conformity with accounting principles generally accepted in the United States, or U.S. GAAP, as set forth in the Financial Accounting Standards Board, or FASB, Accounting Standards Codification, or ASC. The consolidated financial statements include the accounts of Pacific Biosciences and our wholly owned subsidiaries. All intercompany transactions and balances have been eliminated. Certain prior period amounts have been reclassified to conform to the current period presentation.

Use of Estimates

The preparation of financial statements in conformity with GAAP requires us to make estimates and assumptions that affect the amounts reported in the financial statements and accompanying notes to the financial statements. On an ongoing basis, we evaluate our significant estimates including, but not limited to, the valuation of inventory, the determination of stand-alone selling prices for revenue recognition, the fair value of contingent consideration, the valuation of acquired intangible assets, the fair value of certain equity awards, the useful lives assigned to long-lived assets, the computation of provisions for income taxes, the borrowing rate used in calculating the operating lease right-of-use assets and operating lease liabilities, the probability associated with variable payments under partnership development agreements, and the valuations related to our convertible senior notes. While the extent of the potential impact of the current macroeconomic conditions and ongoing COVID-19 pandemic on our business is highly uncertain, we considered information available related to assumptions and estimates used to determine the results reported and asset valuations as of December 31, 2022. Actual results could differ materially from these estimates.

Functional Currency

The U.S. dollar is the functional currency of our international operations. We remeasure foreign subsidiaries monetary assets and liabilities to the U.S. dollar and record net gains or losses from remeasurement in other income, net, in the consolidated statement of operations and comprehensive (loss) income.

Cash, Cash Equivalents, Restricted Cash, and Investments

We consider all highly liquid investments purchased with an original maturity of 90 days or less to be cash equivalents. Cash equivalents may be comprised of money market funds, certificates of deposit, commercial paper, corporate bonds and notes, and government agencies' securities.

We classify our investments in debt securities as available-for-sale and report the investments at fair value in current assets. We evaluate our available-for-sale investments in unrealized loss positions and assess whether the unrealized loss is credit-related. Unrealized gains and losses that are not credit-related are recognized in accumulated other comprehensive (loss) income in stockholders' equity. Realized gains and losses, expected credit losses, as well as interest income, on available-for-sale securities are also reported in other income, net. The cost used in the determination of gains and losses of securities sold is based on the specific identification method. The cost of marketable securities is adjusted for the amortization of premiums and discounts to expected maturity. Premium and discount amortization is recorded in other income, net.

Our investment portfolio at any point in time contains investments in cash deposits, money market funds, commercial paper, corporate debt securities, and U.S. government and agency securities with high credit ratings. We have established guidelines regarding diversification and maturities of investments with the objectives of maintaining safety and liquidity, while maximizing yield.

Restricted cash includes cash that is not readily available for use in the Company's operating activities. Restricted cash is primarily comprised of cash pledged under letters of credit.

Concentration and Other Risks

Financial instruments that potentially subject us to credit risk consist principally of interest-bearing investments and trade receivables. We maintain cash, cash equivalents, and investments with various major financial institutions. The counterparties to the agreements relating to our investment securities consist of various major corporations, financial institutions, municipalities, and government agencies of high credit standing. At December 31, 2022, most of our cash was deposited with U.S. financial institutions. Our investment policy generally restricts the amount of credit exposure to any one issuer. There is no limit to the percentage of the portfolio that may be maintained in securities issued by the U.S. Treasury and U.S. Government Agencies, or other securities fully backed by U.S. Treasury or Government agencies. We have not experienced significant credit losses from financial institutions.

Our trade receivables are derived from revenue to customers and distributors located in the United States and other countries. We perform credit evaluations of our customers' financial condition and, generally, require no collateral from our customers. The allowance for credit losses is based on our assessment of the collectability of customer accounts. We regularly review our trade receivable including consideration of factors such as historical experience, the age of the accounts receivable balances, customer creditworthiness, customer industry, and current and forecasted economic conditions that may affect a customer's ability to pay. We have not experienced any significant credit losses to date.

Although we have historically not experienced significant credit losses, our exposure to credit losses may increase if our customers are adversely affected by changes in economic pressures or uncertainty associated with local or global economic recessions, disruption associated with the current COVID-19 pandemic, or other customer-specific factors.

For the years ended December 31, 2022, 2021, and 2020, one customer accounted for approximately 12%, 13%, and 14% of our total revenue, respectively.

As of December 31, 2022 and 2021, 57% and 53% of our accounts receivable were from domestic customers, respectively. As of December 31, 2022, one customer represented approximately 10% of our net accounts receivable. As of December 31, 2021, no customer represented 10% or greater of our net accounts receivable.

We currently purchase several key parts and components used in the manufacture of our products from a limited number of suppliers. Generally, we have been able to obtain an adequate supply of such parts and components but in certain instances have incurred additional costs to secure a supply of constrained material. An extended interruption in the supply of parts and components currently obtained from our suppliers could adversely affect our business and consolidated financial statements.

Inventory, Net

Inventories are stated at the lower of cost or net realizable value on a first-in, first-out ("FIFO") method. Adjustments to reduce the cost of inventory to its net realizable value, if required, are made for estimated excess or obsolete balances. Cost includes depreciation, labor, material, and overhead costs, including product and process technology costs while determining net realizable value of inventories involves numerous judgements, including projecting future average selling prices, sales volumes, and costs to complete products in work in process inventories.

We make inventory purchases and commitments to meet future shipment schedules based on forecasted demand for our products. The business environment in which we operate is subject to rapid changes in technology and customer demand. We perform a detailed assessment of inventory each period, which includes a review of, among other factors, demand requirements, product life cycle and development plans, component cost trends, product pricing, product expiration, and quality issues. Based on our analysis, we record adjustments to inventory for potentially excess, obsolete, or impaired goods, when appropriate, to report inventory at net realizable value. Inventory adjustments may be required if actual demand, component costs, supplier arrangements, or product life cycles differ from our estimates. Any such adjustments would result in a charge to our results of operations.

Property and Equipment, Net

Property and equipment are stated at cost, reviewed regularly for impairment, and depreciated over the estimated useful lives of the assets, using the straight-line method. Leasehold improvements are depreciated over the shorter of the lease term or the estimated useful life of the related asset. Major improvements are capitalized, while maintenance and repairs are expensed as incurred. Transfers of assets between property and equipment, net, and inventory are transferred at standard cost and recognized at carrying value.

Estimated useful lives of the major classes of property and equipment are as follows:

	Estimated Useful Lives
Leasehold improvements	3 to 10 years
Lab equipment	3 to 5 years
Computer equipment	3 to 5 years
Computer software	3 years
Furniture and fixtures	3 to 5 years

Operating Leases

We record operating lease right-of-use assets and liabilities on our Consolidated Balance Sheets for all leases with a term of more than 12 months. The operating lease right-of-use assets and liabilities are calculated as the present value of remaining minimum lease payments over the remaining lease term using our estimated secured incremental borrowing rates at the commencement date. Lease payments included in the measurement of the lease liability comprise the fixed rent per the term of the Lease. Operating lease expense is recognized on a straight-line basis over the lease term, with variable lease payments, such as common area maintenance fees, recognized in the period incurred.

Business Combinations

Under the acquisition method of accounting, we allocate the fair value of the total consideration transferred to the tangible and identifiable intangible assets acquired and liabilities assumed based on their estimated fair values on the date of acquisition. These valuations require us to make estimates and assumptions, especially with respect to intangible assets. We record the excess consideration over the aggregate fair value of tangible and intangible assets, net of liabilities assumed, as goodwill. Costs that we incur to complete the business combination, such as legal and other professional fees, are expensed as they are incurred.

In connection with certain acquisitions, contingent consideration can be earned by the sellers upon completion of certain future performance milestones. In these cases, a liability is recorded on the acquisition date for an estimate of the acquisition date fair value of the contingent consideration. These estimates require significant management judgment, including probabilities of achieving certain future milestones. Changes in the fair value of the contingent consideration subsequent to the acquisition date are recognized in operating expense in our consolidated statements of operations and comprehensive (loss) income.

If the initial accounting for a business combination is incomplete by the end of a reporting period that falls within the measurement period, we report provisional amounts in our financial statements. During the measurement period, we adjust the provisional amounts recognized at the acquisition date to reflect new information obtained about facts and circumstances that existed as of the acquisition date that, if known, would have affected the measurement of the amounts recognized as of that date. We record these adjustments to the provisional amounts with a corresponding offset to goodwill. Any adjustments identified after the measurement period are recorded in the consolidated statements of income.

Goodwill, Intangible Assets, and Other Long-Lived Assets

Assets acquired, including intangible assets and capitalized in-process research and development (“IPR&D”), and liabilities assumed are measured at fair value as of the acquisition date. Goodwill, which has an indefinite useful life, represents the excess of cost over fair value of the net assets acquired. Intangible assets acquired in a business combination that are used for IPR&D activities are considered indefinite lived until the completion or abandonment of the associated research and development efforts. Upon reaching the end of the relevant research and development project (i.e., upon commercialization), the IPR&D asset is amortized over its estimated useful life. If the relevant research and development project is abandoned, the IPR&D asset is expensed in the period of abandonment.

Goodwill and IPR&D are not amortized; however, they are reviewed for impairment at least annually. We perform annual impairment testing of goodwill in the second quarter of each year and IPR&D in the fourth quarter of each year, or more frequently if indicators of potential impairment exist.

We perform our goodwill impairment analysis at the reporting unit level. We have one reporting unit, which aligns with our reporting structure and availability of discrete financial information. During the goodwill impairment review, we assess qualitative factors to determine whether it is more likely than not that the fair values of our reporting unit is less than the carrying amount, including goodwill. The qualitative factors include, but are not limited to, macroeconomic conditions, industry and market considerations, and our overall financial performance. If, after assessing the totality of these qualitative factors, we determine that it is not more likely than not that the fair value of our reporting unit is less than the carrying amount, then no additional assessment is deemed necessary. Otherwise, we proceed to compare the estimated fair value of the reporting unit with the carrying value, including goodwill. If the carrying amount of the reporting unit exceeds the fair value, we record an impairment loss based on the difference. We may elect to bypass the qualitative assessment in a period and proceed to perform the quantitative goodwill impairment test.

During the IPR&D impairment review, we assess qualitative factors to determine whether it is more likely than not that the fair value of the IPR&D is less than the carrying amount. The qualitative factors include, but are not limited to, macroeconomic conditions, industry-specific conditions, and company-specific conditions. If, after assessing the totality of these qualitative factors, we determine that it is not more likely than not that the fair value of the IPR&D is less than the carrying amount, then no additional assessment is deemed necessary. Otherwise, we proceed to compare the estimated fair value of the IPR&D with the carrying value. If the carrying amount of the IPR&D exceeds the fair value, we record an impairment loss based on the difference. We may elect to bypass the qualitative assessment in a period and proceed to perform the quantitative impairment test.

Finite-lived intangibles assets include our acquired developed technology and customer relationships. We capitalize finite-lived intangibles assets and generally amortize them on a straight-line basis over the estimated useful lives. We regularly review the carrying amount and useful lives of our finite-lived assets to determine whether indicators of impairment may exist which warrant adjustments to carrying values or estimated useful lives. If indicators of impairment exist, an impairment test is performed to assess the recoverability of the affected assets by determining whether the carrying amount of such assets exceeds the undiscounted expected future cash flows. If the affected assets are not recoverable, we estimate the fair value of the assets and record an impairment loss if the carrying value of the assets exceeds the fair value. Factors that may indicate potential impairment include a significant decline in our stock price and market capitalization compared to the net book value, significant changes in the ability of a particular asset to generate positive cash flows for our strategic business objectives, and the pattern of utilization of a particular asset.

Revenue Recognition

Our revenue is generated primarily from the sale of products and services. Product revenue primarily consists of sales of our instruments and related consumables; service and other revenue consist primarily of revenue earned from product maintenance agreements.

We account for a contract with a customer when there is a legally enforceable contract between us and the customer, the rights of the parties are identified, the contract has commercial substance, and collectability of the contract consideration is probable. Revenues are recognized when control of the promised goods, or services is transferred to our customers, or services are performed, in an amount that reflects the consideration we expect to be entitled to in exchange for those goods or services.

Our instrument sales are generally sold in a bundled arrangement and commonly include the instrument, instrument accessories, training, and consumables. For such bundled arrangements, we account for individual products and services separately if they are distinct, that is, if a product or service is separately identifiable from other items in the bundled package and if a customer can benefit from it on its own or with other resources that are readily available to the customer. Installation services are considered distinct from the instrument. Therefore, instrument revenue is recognized upon transfer of control of the asset to the customer, which is generally upon delivery for sales made to our non-distributor customers and upon shipment for sales made to our distributor customers.

The consideration for bundled arrangements is allocated between separate performance obligations based on their individual standalone selling price. We determine the best estimate of standalone selling price using average selling prices over a 12-month period combined with an assessment of current market conditions. If the standalone selling price is not directly observable, we rely on estimates by considering multiple factors including, but not limited to, overall market conditions, including geographic or regional specific factors, internal costs, profit objectives, pricing practices, and other observable inputs. We recognize revenues as performance obligations are satisfied by transferring control of the product or service to the customer or over the term of a product maintenance agreement with a customer. Our revenue arrangements generally do not provide a right of return. Revenue is recorded net of discounts and sales taxes collected on behalf of governmental authorities.

Certain of our agreements provide options to customers which can be exercised at a future date, such as the option to purchase our product at discounted prices, among others. In accounting for customer options, we determine whether an option is a material right and this requires us to exercise significant judgment. If a contract provides the customer an option

to acquire additional goods or services at a discount that exceeds the range of discounts that we typically give for that product or service for the same class of customer, or if the option provides the customer certain additional goods or services for free, the option may be considered a material right. If the contract gives the customer the option to acquire additional goods or services at their normal standalone selling prices, we would likely determine that the option is not a material right and, therefore, account for it as a separate performance obligation when the customer exercises the option. If the standalone selling price of the option is not directly observable, an estimated standalone selling price is utilized which considers adjustments for discounts that the customer could receive without exercising the option and the likelihood that the option will be exercised. We may also utilize the alternative approach to estimate the standalone selling price, available pursuant to the applicable accounting guidance, to the extent we conclude the applicable criteria for using the alternative approach has been met. We update the transaction price for expected consideration, subject to constraint, each reporting period if our estimate of future goods to be ordered by customers change.

Additionally, we generally provide a one-year warranty on instruments. We accrue the cost of the assurance warranty when revenue of the instrument is recognized. Employee sales commissions are generally recorded as selling, general, and administrative expense when incurred as the amortization period for such costs, if capitalized, would have been one year or less.

Cost of Revenue

Cost of revenue reflects the direct cost of product components, third-party manufacturing services, and our internal manufacturing overhead and customer service infrastructure costs incurred to produce, deliver, maintain, and support our instruments, consumables, and services.

Manufacturing overhead is predominantly comprised of labor and facility costs. We capitalize manufacturing overhead into inventory based on a standard cost model that approximates actual costs.

Service costs include the direct costs of components used in support, repair and maintenance of customer instruments as well as the cost of personnel, materials, shipping and support infrastructure necessary to support our installed customer base.

Research and Development

Research and development expense consists primarily of expenses for personnel engaged in the development of our core technology, the design and development of our future products and current product enhancements. These expenses also include prototype-related expenditures, development equipment and supplies, partner development costs, facilities costs, and other related overhead. We expense research and development costs during the period in which the costs are incurred. We defer and capitalize non-refundable advance payments made for research and development activities until the related goods are received or the related services are rendered.

Credit Losses

Trade accounts receivable

The allowance for credit losses is based on our assessment of the collectability of customer accounts. We regularly review the allowance by considering factors such as the age of the accounts receivable balances, customer creditworthiness, customer industry, and current and forecasted economic conditions that may affect a customer's ability to pay. Credit loss expense was immaterial for the years ended December 31, 2022 and 2021.

Available-for-sale debt securities

Our investment portfolio at any point in time contains investments in cash deposits, money market funds, commercial paper, corporate debt securities and U.S. government and agency securities. We regularly assess whether our securities in an unrealized loss position are credit related. The credit-related portion of unrealized losses, and any subsequent improvements, are recorded in interest income. Unrealized losses that are not credit related are included in accumulated other comprehensive income. The unrealized losses on our investments are mainly attributable to government securities, including U.S. government and U.S. agency bond securities, impacted by movements in market rates and not due to issuer credit risk. We have the ability to hold and do not intend to sell the investments in unrealized loss positions before the recovery of their amortized cost bases.

Although we have historically not experienced significant credit losses, our exposure to credit losses may increase if our customers are adversely affected by changes in economic pressures or uncertainty associated with local or global economic recessions, disruptions associated with the evolution of the COVID-19 pandemic, or other customer-specific factors.

Income Taxes

We account for income taxes under the asset and liability method, which requires, among other things, that deferred income taxes be provided for temporary differences between the tax bases of our assets and liabilities and the amounts reported in the financial statements. In addition, deferred tax assets are recorded for the future benefit of utilizing net operating losses and research and development credit carryforwards. The effect of a change in tax rates on the deferred tax assets and liabilities is recognized in the provision for income taxes in the period that includes the enactment date. A full valuation allowance is provided against our net deferred tax assets as it is more likely than not that the deferred tax assets will not be fully realized.

We regularly review our positions taken relative to income taxes. To the extent our tax positions are more likely than not going to result in additional taxes, we accrue the estimated amount of tax related to such uncertain positions.

Share-based Compensation

We account for share-based payments using a fair-value based method for costs related to all share-based payments, including stock options, restricted stock units, and stock issued under our employee stock purchase plan ("ESPP"). We estimate the fair value of share-based payment awards that are stock options and issued under our ESPP on the date of grant using an option-pricing model. See *Note 10. Stockholders' Equity* for further information regarding share-based compensation.

Other Comprehensive (Loss) Income

Other comprehensive (loss) income is comprised of unrealized (losses) gains on our investment securities.

Shipping and Handling

Costs related to shipping and handling are included in cost of revenues for all periods presented.

Earnings per Share

Basic net (loss) income per share is computed by dividing net (loss) income by the weighted-average number of shares of common stock outstanding during the period. Diluted net (loss) income per share is computed using the weighted-average number of shares of common stock outstanding and potential shares assuming the dilutive effect of outstanding stock options, restricted stock units, and common stock issuable pursuant to our ESPP, using the treasury stock method.

Recent Accounting Pronouncements

Recently Adopted Accounting Standards

There are no accounting standards updates ("ASUs") that have been recently adopted and are applicable to our consolidated financial statements.

Accounting Pronouncements Pending Adoption

In October 2021, the FASB issued ASU No. 2021-08, *Business Combinations (Topic 805): Accounting for Contract Assets and Contract Liabilities from Contracts with Customers.* This ASU provides specific guidance on how to recognize contract assets and contract liabilities related to revenue contracts with customers acquired in a business combination. This amendment improves comparability for both the recognition and measurement of acquired revenue contracts with customers at the date of and after a business combination. This authoritative guidance will be effective for us in the first quarter of 2023. The adoption of this guidance is not expected to have a material effect on our consolidated financial statements.

NOTE 2. BUSINESS ACQUISITIONS

Omniome, Inc.

On September 20, 2021, we completed our acquisition of Omniome, Inc. ("Omniome"), a San Diego-based company, to obtain their proprietary short-read DNA sequencing platform capable of delivering high accuracy (the "Omniome acquisition").

In connection with the Omniome acquisition, all outstanding equity securities of Omniome were cancelled in exchange for approximately $315.7 million in cash, 8,911,580 shares of our common stock with a fair value of $249.4 million and contingent consideration with a fair value of $168.6 million. The fair value of the 8,911,580 common shares issued was determined based on the closing market price of PacBio's common shares on the acquisition date.

In addition, approximately $18.9 million, comprised of $7.4 million of cash, 226,811 shares of our common stock with a fair value of $6.3 million, and $5.2 million related to contingent consideration, was accounted for as a one-time post acquisition share-based compensation expense. This share-based compensation expense was due to accelerated vesting of Omniome stock awards in connection with the acquisition.

In connection with the acquisition the contingent consideration of $200 million (composed of $100 million in cash and $100 million in shares of our common stock) is due upon the achievement of a milestone, defined as the first commercial shipment to a customer of a nucleotide sequencing platform, comprising both an instrument and related consumables, that utilizes SBB technology. The number of shares of stock to be issued will be determined using the volume-weighted average of the trading prices of our common stock for the twenty trading days ending with and including the trading day that is two days immediately prior to the achievement of the milestone. Of the $100 million in shares of our common stock to be issued as part of the milestone, $4.1 million was attributable to stock options issued by PacBio in replacement of Omniome's unvested options as part of the transaction. Upon achievement of the milestone, shares will be issued not in excess of an amount equal to 19.9% of our outstanding shares of common stock on the date of closing (prior to the issuance of any shares issued in connection with the transaction or the related private placement), less 11,500,000 shares.

The contingent consideration is accounted for as a liability at fair value, with changes during each reporting period recognized in our Consolidated Statements of Operations and Comprehensive Loss. The fair value of the contingent consideration liability is calculated, with the assistance from a third-party valuation firm, using a scenario-based method that considers a range of possible outcomes and their assigned probabilities of occurrence. The potential outcomes are discounted to present value at a discount rate equal to the sum of the term-matched risk-free-interest rate plus PacBio's credit spread.

Total consideration transferred for the acquisition is as follows (in thousands):

Total cash paid	$	315,703
Fair value of share consideration		249,435
Fair value of contingent consideration		168,574
Less: Share-based compensation expense excluded from consideration transferred		(18,923)
Total consideration transferred	$	714,789

The acquisition was accounted for as a business combination and, accordingly, the total fair value of the consideration transferred was allocated to the tangible and intangible assets acquired and liabilities assumed based on their fair values on the acquisition date. As of December 31, 2021, the major classes of assets and liabilities to which we have allocated the total fair value of the consideration transferred were as follows (in thousands):

Cash and cash equivalents	$	15,338
Property and equipment, net		6,123
Operating lease right-of-use assets, net		18,095
In-process research and development ("IPR&D")		400,000
Goodwill		390,665
Other assets		3,203
Deferred income tax liability		(91,814)
Liabilities assumed		(26,821)
Total consideration transferred	$	714,789

During the year ended December 31, 2021, we recorded a measurement period adjustment of $1.6 million to decrease goodwill and a corresponding $0.4 million to decrease the deferred tax liability on the Consolidated Balance Sheet, and a $1.2 million decrease to our benefit from income taxes on the Consolidated Statements of Operations and Comprehensive (Loss) Income. The measurement period adjustment was due to new information that became available to us upon the completion of the IRC Section 382 Tax Study, where we identified additional net operating losses that are available to us from acquired assets. Refer to *Note 9 – Income Taxes*, in Part II, Item 8 of the *Annual Report on Form 10-K for the year ended December 31, 2021* for more information. There were no measurement period adjustments recorded in the year ended December 31, 2022.

The goodwill recognized was primarily attributable to the assembled workforce and synergies that are expected to occur from the integration of Omniome and is not deductible for income tax purposes.

We incurred costs related to the Omniome acquisition of approximately $12.0 million during the twelve months ended December 31, 2021, which are included in merger-related costs on the Consolidated Statement of Operations and Comprehensive (Loss) Income. No significant merger-related costs were incurred during the twelve months ended December 31, 2022.

The following unaudited pro forma financial information presents combined results of operations for each of the periods presented as if Omniome had been acquired as of the beginning of 2020, giving effect on a pro forma basis to the purchase accounting adjustments such as $12.0 million of PacBio acquisition-related costs, $18.9 million of share-based compensation expense related to acceleration of certain Omniome stock options not attributable to pre-combination service, and a $91.0 million one-time income tax benefit from the reduction of our deferred tax asset valuation allowance resulting from the Omniome acquisition, as well as a pro forma adjustment to reflect $16.7 million of Omniome's acquisition-related costs.

The unaudited pro forma information presented below is for informational purposes only and is not necessarily indicative of the consolidated results of the combined business had the acquisition actually occurred at the beginning of 2020 or the results of future operations of the combined business.

The following table summarizes the unaudited pro forma financial information:

	Years Ended December 31,	
(in thousands, except per share amounts)	2021	2020
Pro forma total revenue	$ 130,513	$ 78,893
Pro forma net (loss) income	$ (278,451)	$ 17,510
Pro forma net (loss) income per share - basic and diluted	$ (1.27)	$ 0.09

Our consolidated financial statements include the results of operations for Omniome beginning September 20, 2021. Revenues of $0 and a net loss of $15.6 million from the acquired Omniome business have been included in our Consolidated Statement of Operations and Comprehensive (Loss) Income for the twelve months ended December 31, 2021.

Circulomics, Inc.

On July 20, 2021, we acquired Circulomics Inc. ("Circulomics"), a Maryland-based biotechnology company focused on delivering highly differentiated sample preparation products that enable genomic workflows (the "Circulomics acquisition").

We paid $29.5 million in cash in exchange for all outstanding shares of common stock of Circulomics. We allocated the consideration transferred to the identifiable assets acquired and liabilities assumed based on their respective fair values at the date of the completion of the Circulomics acquisition. The major classes of assets and liabilities to which we have allocated the total fair value of the consideration transferred were as follows (in thousands):

Cash and cash equivalents	$ 987
Property and equipment, net	214
Intangible assets	11,360
Goodwill	19,309
Other assets	467
Deferred income tax liability	(2,672)
Liabilities assumed	(118)
Total consideration transferred	$ 29,547

The excess of the value of consideration paid over the aggregate fair value of those net assets has been recorded as goodwill. We recognized goodwill of $19.3 million, which is primarily attributable to the synergies expected from capabilities in extraction and sample preparation and is not deductible for income tax purposes. We recorded $11.4 million for the fair value of acquired intangible assets, which consists of developed technology and customer relationships.

NOTE 3. INVITAE COLLABORATION

On June 24, 2022, we entered into an Amended and Restated Development and Commercialization Agreement (the "Amended and Restated Agreement") with Invitae Corporation ("Invitae"). The Amended and Restated Agreement amended and restated the existing Development and Commercialization Agreement, effective as of January 12, 2021, as amended by Amendment No. 1 to Development and Commercialization Agreement, entered into on June 3, 2021, by and between us and Invitae (together, the "Original Agreement"). Unless otherwise agreed in writing or terminated in accordance with the Amended and Restated Agreement, the term of the Amended and Restated Agreement shall continue until June 30, 2028 ("Term").

Pursuant to the Original Agreement, Invitae provided certain funding to us to develop products relating to production-scale high-throughput sequencing ("Program Products"). If Program Products were to become commercially available, Invitae had the right to purchase the Program Products at preferred pricing.

Under the Amended and Restated Agreement, we will continue to receive feedback, input and insight from Invitae in connection with the intended development of our new sequencing systems; however, such feedback will not be contractually required, and Invitae has no contractual right to participate in decisions regarding the development program for such new sequencing systems. Our development plans for such new sequencing systems will be at our discretion and pursuant to our own internal processes and programs. Invitae will not be contractually obligated to reimburse us for development costs under the Amended and Restated Agreement. There can be no assurances that the in-development sequencing systems will continue to be developed, be successfully developed or become available for commercial sale.

In consideration of the non-refundable payments received from Invitae pursuant to the Original Agreement of $23.5 million, we will provide Invitae with credits in connection with Invitae's anticipated purchase of certain currently available and in-development sequencing systems (instruments and consumables). The credits will expire on June 30, 2025 ("Credit Expiration Date"). Subject to certain conditions, Invitae will also be entitled to most favored pricing for the Company's Sequel IIe systems and certain in-development systems through the Term.

We and Invitae may terminate the Amended and Restated Agreement if the other party remains in material breach of the Amended and Restated Agreement following a cure period to remedy the material breach.

The Amended and Restated Agreement is deemed a contract modification and accounted for on a prospective basis in accordance with ASC Topic 606. We will recognize proportionate amounts of the transaction price, including payments made by Invitae to us pursuant to the Original Agreement, in revenue as the remaining performance obligations are satisfied, which is when Invitae places purchase orders for certain currently available and in-development sequencing platforms and the associated goods are delivered. Any remaining unused credits will be recognized when they expire.

During the year ended December 31, 2022, Invitae purchased certain currently available instruments, for which $3.7 million of revenue was recognized as product revenue on the Consolidated Statements of Operations and Comprehensive (Loss) Income under the terms of the Amended and Restated Agreement.

As of December 31, 2022, $21.4 million of deferred revenue, current, is recorded on the Consolidated Balance Sheet relating to all future performance obligations under the Amended and Restated Agreement.

NOTE 4. TERMINATION OF MERGER WITH ILLUMINA

On November 1, 2018, we entered into an Agreement and Plan of Merger (as amended, the "Illumina Merger Agreement") with Illumina, Inc. ("Illumina") and FC Ops Corp., a wholly owned subsidiary of Illumina ("Illumina Merger Sub"). On January 2, 2020, we, Illumina and Illumina Merger Sub, entered into an agreement to terminate the Merger Agreement (the "Termination Agreement").

Continuation Advances from Illumina

As part of the Termination Agreement, Illumina paid us cash payments ("Continuation Advances") totaling $52 million. Up to the full $52.0 million of Continuation Advances paid to us were repayable without interest to Illumina if, within two years of March 31, 2020, we entered into, or consummated a Change of Control Transaction or raised at least $100 million in a single equity or debt financing (that may have multiple closings), with the amount repayable dependent on the amount raised by us.

Resulting from the issuance and sale of $900 million of 1.50% Convertible Senior Notes due February 15, 2028, $52.0 million of Continuation Advances were paid without interest to Illumina in February 2021 and recorded a non-operating expense in the Consolidated Statements of Operations and Comprehensive (Loss) Income for the year ended December 31, 2021.

NOTE 5. FINANCIAL INSTRUMENTS

Fair Value of Financial Instruments

Fair value is the exchange price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date.

The fair value hierarchy established under GAAP requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value. The three levels of inputs that may be used to measure fair value are as follows:

- Level 1: quoted prices in active markets for identical assets or liabilities;
- Level 2: inputs other than Level 1 that are observable, either directly or indirectly, such as quoted prices in active markets for similar assets or liabilities, quoted prices for identical or similar assets or liabilities 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; and
- 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.

We consider an active market as one in which transactions for the asset or liability occurs with sufficient frequency and volume to provide pricing information on an ongoing basis. Conversely, we view an inactive market as one in which there are few transactions for the asset or liability, the prices are not current, or price quotations vary substantially either over time or among market makers. Where appropriate, our non-performance risk, or that of our counterparty, is considered in determining the fair values of liabilities and assets, respectively.

We classify our cash deposits and money market funds within Level 1 of the fair value hierarchy because they are valued using bank balances or quoted market prices. We classify our investments as Level 2 instruments based on market pricing and other observable inputs. We did not classify any of our investments within Level 3 of the fair value hierarchy.

Assets and liabilities measured at fair value are classified in their entirety based on the lowest level input that is significant to the fair value measurement. Our assessment of the significance of a particular input to the entire fair value measurement requires management to make judgments and consider factors specific to the asset or liability.

The carrying amount of our accounts receivable, prepaid expenses, other current assets, accounts payable, accrued expenses and other liabilities, current, approximate fair value due to their short maturities.

Assets and Liabilities Measured at Fair Value on a Recurring Basis

The following table sets forth the fair value of our financial assets and liabilities that were measured on a recurring basis as of December 31, 2022 and December 31, 2021, respectively:

	December 31, 2022				December 31, 2021			
(in thousands)	Level 1	Level 2	Level 3	Total	Level 1	Level 2	Level 3	Total
Assets								
Cash and cash equivalents:								
Cash and money market funds	$ 137,636	$ —	$ —	$ 137,636	$ 327,315	$ —	$ —	$ 327,315
Commercial paper	—	166,453	—	166,453	—	133,185	—	133,185
U.S. government & agency securities	—	21,000	—	21,000	—	225	—	225
U.S. Treasury security	—	—	—	—	—	—	—	—
Total cash and cash equivalents	137,636	187,453	—	325,089	327,315	133,410	—	460,725
Investments:								
Commercial paper	—	127,302	—	127,302	—	187,632	—	187,632
Corporate debt securities	—	49,491	—	49,491	—	8,968	—	8,968
U.S. government & agency securities	—	270,436	—	270,436	—	387,075	—	387,075
Total investments	—	447,229	—	447,229	—	583,675	—	583,675
Short-term restricted cash	300	—	—	300	500	—	—	500
Long-term restricted cash	2,922	—	—	2,922	4,592	—	—	4,592
Total assets measured at fair value	$ 140,858	$ 634,682	$ —	$ 775,540	$ 332,407	$ 717,085	$ —	$ 1,049,492
Liabilities								
Contingent consideration	$ —	$ —	$ 172,094	$ 172,094	$ —	$ —	$ 169,717	$ 169,717
Total liabilities measured at fair value	$ —	$ —	$ 172,094	$ 172,094	$ —	$ —	$ 169,717	$ 169,717

We classify contingent consideration, which was incurred in connection with the acquisition of Omniome, within Level 3 as factors used to develop the estimate of fair value include unobservable inputs that are not supported by market activity and are significant to the fair value.

We estimate the fair value of the contingent consideration liability by discounting the probability-weighted outcomes to present value using an estimate of our borrowing rate and the risk-free rate. The potential outcomes of milestone achievement dates are within the period from June 30, 2023 to June 30, 2025. A decrease in the probability of an earlier scenario within this range would result in a decrease in the fair value of the liability. The discount rates used are the sum of the U.S. risk-free rate and the estimated subordinated credit spread for B- and B credit rating, which ranges from 10.1% to 10.5%. Changes in our estimated subordinated credit spread can result in changes in the fair value of the contingent consideration liability, where a lower credit spread may result in an increased liability valuation.

Changes in the estimated fair value of the contingent consideration liability for the year ended December 31, 2022 were as follows:

(in thousands)	Level 3
Beginning balance as of December 31, 2021	$ 169,717
Change in estimated fair value	2,377
Ending balance as of December 31, 2022	$ 172,094

Changes to the fair value are recorded as the Change in fair value of contingent consideration in the Consolidated Statement of Operations and Comprehensive (Loss) Income.

For the year ended December 31, 2022, there were no transfers between Level 1, Level 2, or Level 3 assets or liabilities reported at fair value on a recurring basis and our valuation techniques did not change compared to the prior year.

Cash, Cash Equivalents, Restricted Cash, and Investments

The following table summarizes our cash, cash equivalents, restricted cash, and investments:

	December 31, 2022			
(in thousands)	Amortized Cost	Gross unrealized gains	Gross unrealized losses	Fair Value
Cash and cash equivalents:				
Cash and money market funds	$ 137,636	$ —	$ —	$ 137,636
Commercial paper	166,514	—	(61)	166,453
U.S. government & agency securities	20,994	6	—	21,000
Total cash and cash equivalents	325,144	6	(61)	325,089
Investments:				
Commercial paper	127,626	9	(333)	127,302
Corporate debt securities	49,998	—	(507)	49,491
U.S. government & agency securities	274,315	1	(3,880)	270,436
Total investments	451,939	10	(4,720)	447,229
Total cash, cash equivalents, and investments	$ 777,083	$ 16	$ (4,781)	$ 772,318
Short-term restricted cash	$ 300	$ —	$ —	$ 300
Long-term restricted cash	$ 2,922	$ —	$ —	$ 2,922

	December 31, 2021			
(in thousands)	Amortized Cost	Gross unrealized gains	Gross unrealized losses	Fair Value
Cash and cash equivalents:				
Cash and money market funds	$ 327,316	$ —	$ —	$ 327,316
Commercial paper	133,190	—	(5)	133,185
U.S. government & agency securities	225	—	—	224
Total cash and cash equivalents	460,731	—	(5)	460,725
Investments:				
Commercial paper	187,705	—	(73)	187,632
Corporate debt securities	8,964	9	(5)	8,968
U.S. government & agency securities	388,088	1	(1,014)	387,075
Total investments	584,757	10	(1,092)	583,675
Total cash, cash equivalents, and investments	$ 1,045,488	$ 10	$ (1,097)	$ 1,044,400
Short-term restricted cash	$ 500	$ —	$ —	$ 500
Long-term restricted cash	$ 4,592	$ —	$ —	$ 4,592

The following table summarizes the contractual maturities of our cash equivalents and available-for-sale investments, excluding money market funds, as of December 31, 2022:

(in thousands)	Fair Value
Due in one year or less	$ 564,752
Due after one year through 5 years	69,930
Total investments	$ 634,682

Actual maturities may differ from contractual maturities because issuers may have the right to call or prepay obligations without call or prepayment penalties.

NOTE 6. BALANCE SHEET COMPONENTS

Inventory, Net

Inventory, net, consisted of the following components:

(in thousands)	December 31, 2022	December 31, 2021
Purchased materials	$ 24,139	$ 7,993
Work in process	14,062	8,611
Finished goods	12,180	7,995
Inventory, net	$ 50,381	$ 24,599

Property and Equipment, Net

Property and equipment, net, consisted of the following components:

(in thousands)	December 31, 2022	December 31, 2021
Laboratory equipment and machinery	$ 38,998	$ 31,534
Leasehold improvements	34,129	31,114
Computer equipment	18,438	15,059
Software	6,879	5,578
Furniture and fixtures	3,426	3,202
Construction in progress	4,698	2,303
Total	106,568	88,790
Less: Accumulated depreciation	(64,988)	(56,286)
Property and equipment, net	$ 41,580	$ 32,504

Construction in progress consists of capitalizable costs that have been incurred for the construction of long-lived assets, and is primarily comprised of amounts that will be classified as lab equipment.

Depreciation expense during the years ended December 31, 2022, 2021, and 2020 was $9.5 million, $7.2 million, and $6.4 million, respectively.

Goodwill and intangible Assets

Goodwill

As of December 31, 2022 and 2021, the goodwill balance was $410.0 million. Goodwill is reviewed for impairment at least annually during the second quarter, or more frequently if an event occurs indicating the potential for impairment. We performed our annual assessment for goodwill impairment in the second quarter of 2022, noting no impairment.

Acquired Intangible Assets

Intangible assets include acquired IPR&D of $400 million as a result of the Omniome acquisition in September 2021. As of December 31, 2022, the research and development project had not been completed or abandoned and, therefore, the IPR&D intangible asset is not currently subject to amortization. IPR&D is reviewed for impairment at least annually, or more frequently if an event occurs indicating the potential for impairment. We performed our annual assessment for IPR&D impairment in the fourth quarter of 2022, noting no impairment.

In addition to IPR&D, we had the following acquired definite-lived intangible assets as of December 31, 2022 (in thousands, except years):

	Estimated Useful Life (in years)	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount
Developed technology	15	$ 11,179	$ (1,039)	$ 10,140
Customer relationships	2	360	(255)	105
Total		$ 11,539	$ (1,294)	$ 10,245

Amortization expense of intangibles was $0.9 million and $0.4 million for the years ended December 31, 2022 and 2021, respectively. We had no amortization expense of intangibles for the year ended December 31, 2020.

The estimated future amortization expense of acquisition-related intangible assets with definite lives is estimated as follows (in thousands):

2023	$ 853
2024	745
2025	745
2026	745
2027	746
2028 and thereafter	6,411
Total	$ 10,245

Accrued Expenses

Accrued expenses consisted of the following components:

	December 31,	
(in thousands)	2022	2021
Salaries and benefits	$ 17,432	$ 25,282
Accrued interest payable	5,100	5,100
Accrued purchase commitments	3,705	—
Accrued product development costs	2,326	1,936
Accrued professional services and legal fees	1,005	1,640
Inventory accrual	332	108
Warranty accrual	1,651	594
Other	1,045	1,601
Accrued expenses	$ 32,596	$ 36,261

Product Warranties

We generally provide a one-year warranty on instruments. In addition, we provide a limited warranty on consumables. At the time revenue is recognized, an accrual is established for estimated warranty costs based on historical experience as well as anticipated product performance. We periodically review the warranty reserve for adequacy and adjust the warranty accrual, if necessary, based on actual experience and estimated costs to be incurred. Warranty expense is recorded as a component of cost of product revenue. There were no material changes in estimates for the periods presented below.

Changes in the reserve for product warranties were as follows:

	Years Ended December 31,	
(in thousands)	2022	2021
Balance at beginning of period	$ 594	$ 161
Additions charged to cost of product revenue	3,199	2,120
Repairs and replacements	(2,142)	(1,687)
Balance at end of period	$ 1,651	$ 594

Deferred Revenue

As of December 31, 2022, we had a total of $32.3 million of deferred revenue, $30.5 million of which was recorded as deferred revenue, current and primarily relates to future performance obligations under the Amended and Restated Agreement with Invitae as described in *Note 3. Invitae Collaboration*. The deferred revenue, non-current balance of $1.8 million primarily relates to deferred service contract revenues and is scheduled to be recognized in the next 6 years. Revenue recorded in the year ended December 31, 2022 includes $13.0 million of previously deferred revenue that was included in deferred revenue, current as of December 31, 2021.

Term Loans

In connection with the acquisition of Omniome, we acquired $1.3 million in short-term debt and $3.0 million in long-term debt relating to a term loan facility that Omniome obtained in April 2020. Borrowings on the term loan facility were used to fund Omniome's purchases of equipment, which serves as collateral. Each term loan has a term of 43 months and bears a fixed interest rate of approximately 17% annually. The fee for the elective option to prepay all, but not less than all, of the borrowed amounts at any time after the 24th month and before the 43rd month after the commencement date, is 4% of the outstanding loan balance. Payments are made in equal monthly installments including principal and interest.

As of December 31, 2022, the carrying value of term loans outstanding was $2.3 million. The related long-term portion of $0.5 million was recorded as part of other liabilities, non-current and the short-term portion of $1.8 million was recorded as part of other liabilities, current on the Consolidated Balance Sheet. The interest expense was $0.6 million for the year ended December 31, 2022, which was included as part of interest expense in the Consolidated Statement of Operations and Comprehensive (Loss) Income.

As of December 31, 2022, the future principal payments remaining on term loans was the following:

(in thousands)	
2023	$ 1,842
2024	490
Total	$ 2,332

Other Liabilities, Current

Other liabilities, current, consisted of the following components:

	December 31,	
(in thousands)	2022	2021
Accrued Employee Stock Purchase Plan	$ 3,638	$ 3,598
Short-term loan	1,842	1,608
Other	1,753	553
Other liabilities, current	$ 7,233	$ 5,759

NOTE 7. CONVERTIBLE SENIOR NOTES

On February 9, 2021, we entered into an investment agreement (the "Investment Agreement") with SB Northstar LP (the "Purchaser"), a subsidiary of SoftBank Group Corp., relating to the issuance and sale to the Purchaser of $900 million in aggregate principal amount of our 1.50% Convertible Senior Notes (the "Notes"). The Notes were issued on February 16, 2021.

The Notes are governed by an indenture (the "Indenture") between the Company and U.S. Bank National Association, as trustee. The Notes bear interest at a rate of 1.50% per annum. Interest on the Notes is payable semi-annually in arrears on February 15 and August 15 and commenced on August 15, 2021. The Notes will mature on February 15, 2028, subject to earlier conversion, redemption, or repurchase.

The Notes are convertible at the option of the holder at any time until the second scheduled trading day prior to the maturity date, including in connection with a redemption by the Company. The Notes are convertible into shares of our common stock based on an initial conversion rate of 22.9885 shares of common stock per $1,000 principal amount of the Notes (which is equal to an initial conversion price of $43.50 per share), in each case subject to customary anti-dilution and other adjustments as a result of certain extraordinary transactions. Upon conversion of the Notes, we may elect to settle such conversion obligation in shares, cash or a combination of shares and cash.

On or after February 20, 2026, the Notes will be redeemable by the Company in the event that the closing sale price of our common stock has been at least 150% of the conversion price then in effect for at least 20 trading days (whether or not consecutive) during any 30 consecutive trading day period (including the last trading day of such period) ending on, and including, the trading day immediately preceding the date on which we provide the redemption notice at a redemption price of 100% of the principal amount of such Notes, plus accrued and unpaid interest up to, but excluding, the redemption date.

With certain exceptions, upon a change of control of the Company or the failure of our common stock to be listed on certain stock exchanges (a "Fundamental Change"), the holders of the Notes may require that we repurchase all or part of the principal amount of the Notes at a purchase price of par plus unpaid interest up to, but excluding, the maturity date.

The Indenture includes customary "events of default," which may result in the acceleration of the maturity of the Notes under the Indenture. The Indenture also includes customary covenants for convertible notes of this type.

To the extent we elect, the sole remedy for an event of default relating to our failure to comply with certain of our reporting obligations shall, for the first 360 calendar days after the occurrence of such an event of default, consist exclusively of the right to receive additional interest on the Notes at a rate equal to (i) 0.25% per annum of the principal amount of the Notes outstanding for each day during the first 180 calendar days of the 360-day period after the occurrence of such an event of default during which such event of default is continuing (or, if earlier, the date on which such event of default is cured or waived) and (ii) 0.50% per annum of the principal amount of the Notes outstanding for each day from, and including, the 181st calendar day to, and including, the 360th calendar day after the occurrence of such an event of default during which such event of default is continuing (or, if earlier, the date on which such event of default is cured or waived as provided for in the Indenture). On the 361st day after such event of default (if the event of default relating to our failure to comply with its obligations is not cured or waived prior to such 361st day), the Notes shall be subject to acceleration as provided for in the Indenture.

The Notes are accounted for in accordance with the authoritative guidance for convertible debt instruments that may be settled in cash upon conversion. Under ASU 2020-06, the guidance requires that debt with an embedded conversion feature is accounted for in its entirety as a liability and no portion of the proceeds from the issuance of the convertible debt instrument is accounted for as attributable to the conversion feature unless the conversion feature is required to be accounted for separately as an embedded derivative or the conversion feature results in a substantial premium. The conversion feature of the Notes is not accounted for as an embedded derivative because it is considered to be indexed to our common stock, and the Notes were not issued at a premium; therefore, the Notes are accounted for in their entirety as a liability. Because we may elect to settle any conversions entirely in shares, and because settlement in shares is the default settlement method, the liability is classified as non-current.

The requirement to repurchase the Notes including unpaid interest to the maturity date in the event of a Fundamental Change is considered a put option for certain periods requiring bifurcation under ASC 815 – *Derivatives and Hedging.* However, given the low probability of a Fundamental Change occurring during the applicable periods, the value of the embedded derivative is immaterial.

The additional interest feature in the event of our failure to comply with certain reporting obligations is also considered an embedded derivative requiring bifurcation under ASC 815. However, due to the nature and terms of the reporting obligations, the value of the embedded derivative is immaterial.

We incurred issuance costs related to the Notes of approximately $4.5 million, which were recorded as debt issuance cost and are presented as a reduction to the Notes on our Consolidated Balance Sheets and are amortized to interest expense using the effective interest method over the term of the Notes, resulting in an effective interest rate of 1.6%.

As of December 31, 2022, the net carrying amount of the liability for the Notes is recorded as convertible senior notes, net in the Consolidated Balance Sheets as follows (in thousands):

Principal amount	$	900,000
Unamortized debt issuance costs		(3,317)
Net carrying amount	$	896,683

Interest expense for the Notes was as follows for the years ended December 31, 2022, 2021, and 2020:

	Years Ended December 31,		
(in thousands)	2022	2021	2020
Contractual interest expense	$ 13,500	$ 11,812	$ -
Amortization of debt issuance costs	617	532	-
Total interest expense	$ 14,117	$ 12,344	$ -

As of December 31, 2022, the estimated fair value (Level 2) of the Notes was $604.8 million. The fair value of the Notes is estimated using a pricing model that is primarily affected by the trading price of our common stock and market interest rates.

NOTE 8. COMMITMENTS AND CONTINGENCIES

Leases

We record operating lease right-of-use assets and liabilities on our Consolidated Balance Sheets for all leases with a term of more than 12 months. In connection with the acquisition of Omniome, we acquired $18.1 million in right-of-use assets and liabilities on our Consolidated Balance Sheets. The operating lease right-of-use assets and liabilities are calculated as the present value of remaining minimum lease payments over the remaining lease term using our estimated secured incremental borrowing rates at the commencement date. Lease payments included in the measurement of the lease liability comprise the fixed rent per the term of the Lease. All of our leases are operating leases. Lease payments comprise the base rent per the term of the Lease. Lease expense for these leases is recognized on a straight-line basis over the lease term, with variable lease payments, such as common area maintenance fees, recognized in the period those payments are incurred.

We often have options to renew lease terms for buildings. In addition, certain lease arrangements may be terminated prior to their original expiration date at our discretion. We evaluate renewal and termination options at the lease commencement date to determine if we are reasonably certain to exercise the option on the basis of economic factors.

As of December 31, 2022, the maturities of our operating lease liabilities were as follows:

(in thousands)		
2023	$	11,955
2024		12,018
2025		12,279
2026		12,392
2027		9,930
Thereafter		—
Total undiscounted operating lease payments		58,574
Less: imputed interest		(8,618)
Present value of operating lease liabilities	$	49,956

Balance Sheet Classification		
Operating lease liabilities, current	$	8,886
Operating lease liabilities, non-current		41,070
Total operating lease liabilities	$	49,956

We use our incremental borrowing rate to determine the present value of lease payments, as the implicit rates in our leases are not readily determinable. The weighted-average discount rate used to measure our operating lease liabilities was 6.7%. The weighted-average remaining lease term for our operating leases as of December 31, 2022 was 4.7 years.

Cash Flows

Cash paid for amounts included in the present value of operating lease liabilities was $11.2 million and $8.2 million for the years ended December 31, 2022 and 2021, respectively, and were included in operating cash flow.

Operating Lease Costs

Operating lease costs were $10.5 million and $7.2 million for the years ended December 31, 2022 and 2021, respectively.

Contingencies

We may become involved in legal proceedings, claims and assessments from time to time in the ordinary course of business. We accrue liabilities for such matters when it is probable that future expenditures will be made and such expenditures can be reasonably estimated.

We do not believe that the ultimate outcome of any such pending matters is probable or reasonably estimable, or that these matters will have a material adverse effect on our business; however, the results of litigation and claims are inherently unpredictable. Regardless of the outcome, litigation can have an adverse impact on us because of litigation and settlement costs, diversion of management resources, and other factors.

Please see subsection titled *Legal Proceedings*, in Part I, Item 3 of this Annual Report on Form 10-K.

Indemnification

Pursuant to Delaware law and agreements entered into with each of our directors and officers, we may have obligations, under certain circumstances, to hold harmless and indemnify each of our directors and officers against losses suffered or incurred by the indemnified party in connection with their service to us, and judgements, fines, settlements and expenses related to claims arising against such directors and officers to the fullest extent permitted under Delaware law, our bylaws and our certificate of incorporation. We also enter and have entered into indemnification agreements with our directors and officers that may require us to indemnify them against liabilities that arise by reason of their status or service as directors or officers, except as prohibited by applicable law. In addition, we may have obligations to hold harmless and indemnify third parties involved with our fundraising efforts and their respective affiliates, directors, officers, employees, agents or other representatives against any and all losses, claims, damages and liabilities related to claims arising against such parties pursuant to the terms of agreements entered into between such third parties and us in connection with such fundraising efforts. To the extent that any such indemnification obligations apply to the lawsuits described above, any associated expenses incurred are included within the related accrued litigation expense amounts. No additional liability associated with such indemnification obligations has been recorded as of December 31, 2022.

Purchase Commitments

In the normal course of business, we enter into agreements to purchase goods or services or license intellectual property, certain of which are not cancelable without penalty. For those agreements with variable terms, we do not estimate the total obligation beyond any minimum quantities or pricing as of the reporting date. Licensing agreements under which we commit to ongoing minimum royalty payments, some of which are subject to adjustment, may be terminated under certain circumstances.

Our purchase orders and contractual obligations are approximately $145.7 million as of December 31, 2022, which consist of open purchase orders and contractual obligations in the ordinary course of business, including commitments with contract manufacturers and suppliers for which we have not received the goods or services. A majority of these purchase obligations are due within a year. Although open purchase orders are considered enforceable and legally binding, the terms generally allow us the option to cancel, reschedule and adjust our requirements based on our business needs prior to the delivery of goods or performance of services.

We recognized a loss on purchase commitment of $3.7 million for the year ended December 31, 2022, which was recorded as part of accrued expenses on the Consolidated Balance Sheet and is included in the aforementioned purchase orders and contractual obligations amount. The purchase commitment loss is based on an estimate of future excess inventory related to a supply agreement with a third-party vendor, for which we do not expect to have related sales.

We have a long-term supply agreement, which was amended in October 2022 (the "Supply Agreement"), for the purchase of certain products with a semiconductor manufacturer ("Supplier"). The Supply Agreement provides for minimum purchase commitments through 2026 on our part in exchange for guaranteed capacity at Supplier. We are responsible for providing certain materials to allow our Supplier to perform its obligations under the contract.

We paid our Supplier a deposit of $9.0 million in November 2022 and will pay an additional deposit of $6.0 million in 2023, for a total of $15.0 million (the "Deposit"). The Deposit is fully refundable to us, in accordance with the Supply Agreement, if we meet the minimum volume purchase commitment for the applicable year. As of December 31, 2022, $9.0 million related to the Deposit was included in other long-term assets in the Consolidated Balance Sheets, as we believe it is probable the minimum volume purchase commitment level will be achieved.

NOTE 9. INCOME TAXES

We are subject to income taxes in the United States and certain states in which we operate, and we use estimates in determining our provisions for income taxes. Significant management judgement is required in determining our provision for income taxes, deferred tax assets and liabilities, and valuation allowances recorded against net deferred tax assets in accordance with U.S. GAAP. These estimates and judgements occur in the calculation of tax credits, benefits, and deductions, and in the calculation of certain tax assets and liabilities, which arise from differences in the timing of recognition of revenue and expense for tax and financial statement purposes, as well as the interest and penalties related to uncertain tax positions. Significant changes to these estimates may result in an increase or decrease to our tax provision in the current or subsequent period.

We assess all material positions taken in any income tax return, including all significant uncertain positions, in all tax years that are still subject to assessment or challenge by relevant taxing authorities. Assessing an uncertain tax position begins with the initial determination of the position's sustainability and is measured at the largest amount of benefit that is greater than 50% likely of being realized upon ultimate settlement. As of each balance sheet date, unresolved uncertain tax positions must be reassessed, and we will determine whether the factors underlying the sustainability assertion have changed and the amount of the recognized tax benefit is still appropriate.

We account for Global Intangible Low-taxed Income as a period cost.

During the years ended December 31, 2022, 2021, and 2020 (loss) income before taxes from U.S. operations were ($315.7) million, ($275.4) million, and $28.9 million, respectively, and income before taxes from foreign operations was $1.8 million, $0.8 million, and $0.6 million, respectively.

Income tax provision (benefit) related to continuing operations differ from the amounts computed by applying the statutory income tax rate of 21% to pretax income or loss as follows:

	Years ended December 31,		
	2022	2021	2020
Statutory tax rate	21.0 %	21.0 %	21.0 %
State tax rate, net of federal benefit	4.4	5.5	(8.3)
Change in valuation allowance	(25.1)	(4.9)	6.3
Tax credits	2.2	2.5	(3.6)
Share-based compensation	(2.2)	10.9	(15.2)
Merger Expenses	-	(0.9)	-
Other	(0.4)	(0.1)	(0.2)
Total	(0.1)%	34.0 %	0.0 %

Deferred income taxes reflect the net tax effects of loss and credit carry forwards and temporary differences between the carrying amounts of assets and liabilities for financial reporting purposes and the amounts used for income tax purposes. Significant components of our deferred tax assets for federal and state income taxes are as follows (in thousands):

	December 31,	
	2022	2021
Deferred tax assets:		
Net operating loss carryforwards	$ 400,629	$ 378,035
Research and development credits	71,526	60,672
Capitalized research and experimental expenses	34,863	—
Accruals and reserves	18,417	10,822
Share-based compensation	17,117	12,838
Operating lease liability	11,537	13,105
Total deferred tax assets	554,089	475,472
Less: Valuation allowance	(445,574)	(366,940)
Total deferred tax assets:	108,515	108,532
Intangibles	(98,931)	(97,345)
Fixed assets	(1,262)	(1,523)
Operating lease right-of-use assets	(9,157)	(10,502)
Total deferred tax liabilities	(109,350)	(109,370)
Net deferred tax assets	$ (835)	$ (838)

At December 31, 2022, we maintained a full valuation allowance against all of our deferred tax assets that totaled $445.6 million, including net operating loss carryforwards and research and development credits of $400.6 million and $71.5 million, respectively.

A valuation allowance is recorded when it is more likely than not that all or some portion of the deferred income tax assets will not be realized. We regularly assess the need for a valuation allowance against our deferred income tax assets by considering both positive and negative evidence related to whether it is more likely than not that our deferred income tax assets will be realized. In evaluating our ability to recover our deferred income tax assets within the jurisdiction from which they arise, we consider all available positive and negative evidence, including scheduled reversals of deferred income tax liabilities, projected future taxable income, tax-planning strategies, and results of recent operations. We maintain a valuation allowance on the net deferred tax assets of our U.S. entities as we have concluded that it is more likely than not that we will not realize our deferred tax assets. Accordingly, this benefit from income taxes is reflected on our Consolidated Statements of Operations and Comprehensive (Loss) Income for the year ended December 31, 2022.

For the year ended December 31, 2022, our valuation allowance increased to $445.6 million, primarily because of an increase in our net operating losses, credits, and capitalized research and experimental expenses that were fully offset by a valuation allowance. For the year ended December 31, 2021, our valuation allowance increased to $366.9 million, primarily because of an increase in our net operating losses, credits, and acquisition of deferred tax assets that were fully offset by a valuation allowance.

As of December 31, 2022, we had a net operating loss carryforward for federal income tax purposes of approximately $1,573.8 million, of which $774.9 million will begin to expire in 2024 if not utilized. We had a total state net operating loss carryforward of approximately $1,071.8 million, which are subject to annual expirations. Utilization of some of the federal and state net operating loss and credit carryforwards are subject to annual limitations due to the “change of ownership” provisions of the Internal Revenue Code of 1986 and similar state provisions. The annual limitations may result in the expiration of net operating losses and credits before utilization.

We have federal credits of approximately $47.2 million, which will begin to expire in 2024 if not utilized and state research credits of approximately $42.6 million, which have no expiration date. These tax credits are subject to the same limitations discussed above.

As of December 31, 2022, our total unrecognized tax benefit was $10.4 million. A reconciliation of the beginning and ending unrecognized tax benefit balance is as follows (in thousands):

Balance as of December 31, 2019	$	21,979
Decrease in balance related to tax positions taken in prior year		(17,255)
Increase in balance related to tax positions taken during current year		1,230
Balance as of December 31, 2020		5,954
Increase in balance related to tax positions taken in prior year		189
Increase in balance related to tax positions taken during current year		2,192
Balance as of December 31, 2021		8,335
Decrease in balance related to tax positions taken in prior year		(10)
Increase in balance related to tax positions taken during current year		2,085
Balance as of December 31, 2022	$	10,410

Our practice is to recognize interest and penalties related to income tax matters in income tax expense. As of both December 31, 2022 and 2021, we had no accrued interest or penalties due to our net operating losses available to offset any tax adjustment. If total unrecognized tax benefits were realized in the future, it would not result in any tax benefit as we currently have a full valuation allowance. We file U.S. federal and various state income tax returns. For U.S. federal and state income tax purposes, the statute of limitations currently remains open for the years ending December 31, 2019 to present and December 31, 2018 to present, respectively. In addition, all of the net operating losses and research and development credit carryforwards that may be utilized in future years may be subject to examination. We are not currently under examination by income tax authorities in any jurisdiction.

NOTE 10. STOCKHOLDERS' EQUITY

Preferred Stock

Our Certificate of Incorporation, as amended and restated in October 2010 in connection with the closing of our initial public offering, authorizes us to issue 1,000,000,000 shares of $0.001 par value common stock and 50,000,000 shares of $0.001 par value preferred stock. As of December 31, 2022 and 2021, there were no shares of preferred stock issued or outstanding.

Common Stock

Common stockholders are entitled to dividends when and if declared by our board of directors. There have been no dividends declared to date. The holder of each share of common stock is entitled to one vote.

Underwritten Public Equity Offerings

In August 2020, we entered into an underwriting agreement, relating to the public offering of 19,430,000 shares of our common stock, $0.001 par value per share, at a price to the public of $4.47 per share. Under the terms of the underwriting agreement, we also granted the underwriters a 30-day option to purchase up to an additional 2,914,500 shares of our common stock, which was subsequently exercised in full, and the offering including the sale of shares of common stock subject to the underwriters' option, closed in August 2020. In total, we sold 22.3 million shares of our common stock. We paid a commission equal to 6% of the gross proceeds from the sale of shares of our common stock. The total net proceeds to us from the offering after deducting the underwriting discount were approximately $93.9 million, excluding approximately $0.3 million of offering expenses.

In November 2020, we entered into an underwriting agreement, relating to the public offering of 6,096,112 shares of our common stock, $0.001 par value per share, at a price to the public of $14.25 per share. Under the terms of the underwriting agreement, we also granted the underwriters a 30-day option to purchase up to an additional 914,416 shares of our common stock, which was subsequently exercised in full, and the offering including the sale of shares of common stock subject to the underwriters' option, closed in November 2020. In total, we sold 7.0 million shares of our common stock. We paid a commission equal to 6% of the gross proceeds from the sale of shares of our common stock. The total net proceeds to us from the offering after deducting the underwriting discount were approximately $93.9 million, excluding approximately $0.3 million of offering expenses.

In total, for the year ended December 31, 2020, we issued 29.4 million shares of our common stock through our two underwritten public offerings with an average offering price of $6.40. The total net proceeds to us from the two offerings, after deducting the underwriting commission and offering expenses, were approximately $187.2 million.

Private Placement of Common Stock

On July 19, 2021, in connection with the Omniome acquisition, we entered into a purchase agreement with certain qualified institutional buyers and institutional accredited investors, pursuant to which we agreed to sell an aggregate of 11,214,953 shares of common stock, at a price of $26.75 per share, for aggregate gross proceeds of approximately $300 million. The transaction closed on September 20, 2021. We registered the private placement shares for resale following the closing of the merger.

Equity Plans

The 2020 Equity Incentive Plan (the "2020 Plan"), the 2020 Inducement Equity Incentive Plan (the "Inducement Plan"), and the 2021 adopted Omniome Equity Incentive Plan of Pacific Biosciences of California, Inc. (the "Omniome Plan") allow for the issuance of stock options, restricted units and awards, and performance-based awards.

On August 4, 2020, stockholders approved the 2020 Plan and reserved 11,000,000 shares of our common stock for issuance pursuant to equity awards granted under the 2020 Plan.

On December 2, 2020, the Board of Directors (the "Board") adopted the Inducement Plan and reserved 2,500,000 shares of our common stock for issuance pursuant to equity awards granted under the Inducement Plan. On April 18, 2021 and November 22, 2021, the Board amended the Inducement Plan to reserve an additional 750,000 and 360,000 shares, respectively.

On September 20, 2021, in connection with the acquisition of Omniome, we adopted the Omniome Equity Incentive Plan of Pacific Biosciences of California, Inc. (the "Omniome Plan"). Under the Omniome Merger Agreement, each unvested option to purchase Omniome common stock, granted under the Omniome Plan held by employees continuing with us, was assumed by PacBio and converted into an option to purchase shares of our common stock. The terms and conditions of the converted options are substantially the same (including vesting and exercisability), except that (A) the assumed options cover shares of PacBio's common stock; (B) the number of shares of our common stock subject to the assumed option is equal to the product of (i) the number of shares of Omniome common stock subject to the corresponding unvested option, multiplied by (ii) the exchange ratio (as defined below), with any resulting fractional share rounded down to the nearest whole share; and (C) the exercise price per share of the assumed options is equal to the quotient of (i) the exercise price per share of the corresponding unvested option to purchase shares of Omniome common stock, divided by (ii) the exchange ratio (as defined below), with any resulting fractional cent rounded up to the nearest whole cent. The exchange ratio was equal to 0.259204639. We reserved 2,494,128 shares of our common stock for issuance pursuant to equity awards under the Omniome Plan.

On May 25, 2022, stockholders approved an amendment to the 2020 Plan and we reserved an additional 18,000,000 shares of our common stock for issuance pursuant to equity awards granted under the 2020 Plan.

As of December 31, 2022, we had 18.9 million shares remaining and available for future issuance under the 2020 Plan, Inducement Plan, and the Omniome Plan.

Stock Options

Time-based stock options

The following table summarizes time-based stock option activity for all of our equity compensation plans for the year ended December 31, 2022 (in thousands, except per share amounts):

	Number of shares		Weighted-average exercise price
Outstanding at December 31, 2021	12,159	$	11.38
Granted	5,211	$	10.34
Exercised	(1,052)	$	3.25
Canceled	(1,603)	$	19.66
Expired	(97)	$	24.26
Outstanding at December 31, 2022	14,618	$	10.60

Performance-based stock options

The following table summarizes performance-based stock option activity for all of our equity compensation plans for the year ended December 31, 2022 (in thousands, except per share amounts):

	Number of shares		Weighted-average exercise price
Outstanding at December 31, 2021	304	$	4.71
Granted	—	$	—
Exercised	—	$	—
Canceled	(46)	$	4.71
Outstanding at December 31, 2022	258	$	4.71

The aggregate intrinsic value of outstanding options represents the total pre-tax intrinsic value (i.e. the difference between $8.18, our closing stock price on the last trading day of our fourth quarter of 2022 and the option exercise price multiplied by the number of in-the-money options) that would have been received by the option holders had all option holders exercised their options on December 31, 2022. The aggregate intrinsic value changes at each reporting date based on the fair market value of our common stock.

The aggregate intrinsic value of the outstanding options presented in the table above as of December 31, 2022, totaled $24.7 million, and had a weighted-average remaining contractual life of 6.7 years.

The vested and exercisable options as of December 31, 2022, totaled 9,408,063 shares, had an aggregate intrinsic value of $22.7 million, a weighted-average exercise price per share of $8.45, and a weighted-average remaining contractual life of 5.4 years.

The vested and expected to vest options as of December 31, 2022, totaled 14,436,695 shares, had an aggregate intrinsic value of $24.6 million, a weighted-average exercise price per share of $10.61, and a weighted-average remaining contractual life of 6.5 years.

The total intrinsic value of stock options exercised during the years ended December 31, 2022, 2021, and 2020 was $5.0 million, $146.1 million, and $63.1 million, respectively.

The total intrinsic value of options exercised represents the difference between our closing stock price on the exercise date and the option exercise price, multiplied by the number of in-the-money options exercised.

The weighted-average grant-date fair value of all options granted was $5.93 in 2022, $18.36 in 2021, and $4.14 in 2020, each determined by the Black-Scholes option valuation method.

Restricted Stock Units

Each Restricted Stock Unit (RSU) represents one equivalent share of our common stock to be issued after satisfying the applicable continued service-based vesting criteria over a specified period. These RSUs are time-based and vest over four years at a rate of 25% annually. The fair value for these RSUs is based on the closing price of our common stock on the date of grant. We measure compensation expense for these RSUs at fair value on the date of grant and recognize the expense over the expected vesting period on a straight-line basis. The RSUs do not entitle participants to the rights of holders of common stock, such as voting rights, until the shares are issued. RSUs that are expected to vest are net of estimated future forfeitures.

The following table summarizes the RSU activity for the year ended December 31, 2022 (in thousands, except per share amounts):

	Number of shares		Weighted-average grant date fair value
RSUs outstanding at December 31, 2021	7,392	$	19.78
RSUs granted	5,389	$	10.15
RSUs released	(2,582)	$	15.19
RSUs forfeited	(1,664)	$	19.42
Unvested RSUs outstanding at December 31, 2022	8,535	$	15.16

The total fair value of shares vested related to RSUs during the years ended December 31, 2022, 2021, and 2020 was $39.2 million, $9.2 million, and $6.3 million, respectively.

The weighted-average grant-date fair value of all RSUs granted was $10.15 in 2022, $35.33 in 2021, and $5.18 in 2020.

Employee Stock Purchase Plan

As of December 31, 2022, a total of 25.5 million shares of our common stock have been reserved for issuance under our 2010 Employee Stock Purchase Plan (the “ESPP”). The ESPP permits eligible employees to purchase common stock at a discount through payroll deductions during defined offering periods. Each offering period will generally consist of four purchase periods, each purchase period being approximately six months. The price at which the stock is purchased is equal to the lower of 85% of the fair market value of the common stock at the beginning of an offering period or at the end of a purchase period. Each offering period will generally end and the shares will be purchased twice yearly on March 1 and September 1. If the stock price at the end of the purchase period is lower than the stock price at the beginning of the offering period, that offering period will be terminated and a new offering period will come into place. The ESPP provides for an annual increase to the shares available for issuance at the beginning of each fiscal year equal to the lessor of 2% of the common shares then outstanding, 4,000,000 shares, or an amount determined by the ESPP’s administrator.

Pursuant to the terms of the then-in-process Merger Agreement with Illumina, offerings under our 2010 ESPP were suspended after the completion of the purchase period ended March 1, 2019. After the merger with Illumina was terminated in January 2020, we began offerings under the ESPP again starting with the offering period beginning March 1, 2020.

For the years ended December 31, 2022, 2021, and 2020, 1,878,168 shares, 1,913,968 shares, and 834,677 shares of common stock were purchased under the ESPP, respectively. As of December 31, 2022, 9,932,505 shares of our common stock remain available for issuance under our ESPP.

Share-based Compensation

Total share-based compensation expense consists of the following (in thousands):

	Years Ended December 31,		
	2022	2021	2020
Cost of revenue	$ 4,802	$ 6,126	$ 2,236
Research and development	30,676	20,275	7,061
Sales, general and administrative	43,135	35,403	8,236
Merger-related expenses - stock-settled	—	6,349	—
Merger-related expenses - milestone	—	5,202	—
Share-based compensation	78,613	73,355	17,533
Merger-related expenses - cash-settled	—	7,373	—
Total share-based compensation expense	$ 78,613	$ 80,728	$ 17,533

As of December 31, 2022 and 2021, $0.7 million and $0.9 million of share-based compensation cost was capitalized in inventory, net, on our consolidated balance sheets, respectively.

The tax benefit of share-based compensation expense was immaterial for the years ended December 31, 2022, 2021, and 2020.

Determining Fair Value

We estimate the fair value of share options granted using the Black-Scholes valuation method and a single option award approach. This fair value is then amortized on a straight-line basis over the requisite service periods of the awards, which is generally the vesting period. The fair market value of RSU awards granted is the closing price of our shares on the date of grant and is generally recognized as compensation expense on a straight-line basis over the respective vesting period. For shares purchased under our Employee Stock Purchase Plan, or ESPP, we estimate the grant-date fair value, and the resulting share-based compensation expense, using the Black-Scholes option-pricing model.

Expected Term – The expected term used in the Black-Scholes valuation method represents the period that the stock options are expected to be outstanding and is determined based on historical experience of similar awards, giving consideration to the contractual terms of the stock options and vesting schedules.

Expected Volatility – The expected volatility used in the Black-Scholes valuation method is derived from the implied volatility related to our share price over the expected term.

Expected Dividend – We have never paid dividends on our shares and, accordingly, the dividend yield percentage is zero for all periods.

Risk-Free Interest Rate – The risk-free interest rate used in the Black-Scholes valuation method is the implied yield currently available on U.S. Treasury constant maturities issued with a term equivalent to the expected terms.

Stock Options

We estimated the fair value of employee stock options using the Black-Scholes option pricing model. The fair value of employee stock options is being amortized on a straight-line basis over the requisite service period of the awards.

When determining the current share prices underlying the stock options for calculating the grant-date fair value, we reference observable market prices of similar or identical instruments in active markets.

The fair value of employee stock options was estimated using the following weighted-average assumptions:

	Years Ended December 31,		
	2022	2021	2020
Expected term in years	4.6	2.1 - 4.6	5.0
Expected volatility	70% - 76%	67% - 80%	70.7%
Risk-free interest rate	0.41% – 3.66%	0.05% – 1.10%	0.3%
Dividend yield	—	—	—
Weighted-average grant date fair value per share	$ 5.93	$ 15.53	$ 7.20

Cash received from option exercises for the years ended December 31, 2022, 2021, and 2020 was $3.4 million, $25.4 million and $43.9 million, respectively.

ESPP

We estimate the fair value of shares to be issued under the ESPP using the Black-Scholes option pricing model. The fair value of shares to be issued under the ESPP was estimated using the following assumptions:

	Years Ended December 31,		
	2022	2021	2020
Expected term in years	0.5 - 2.0	0.5 - 2.0	0.5 - 2.0
Expected volatility	70% - 97%	67% - 68%	57% - 71%
Risk-free interest rate	0.60% - 3.51%	0.1% - 0.2%	0.1%-1.0%
Dividend yield	—	—	—
Weighted-average grant date fair value per share	$ 4.28	$ 25.07	$ 1.87

Cash received through the ESPP for the years ended December 31, 2022, 2021, and 2020 was $7.8 million, $6.4 million, and $2.4 million, respectively.

As of December 31, 2022, $125.1 million of total unrecognized compensation expense related to stock options, restricted stock, and ESPP shares was expected to be recognized over a weighted-average period of 2.4 years.

NOTE 11. NET (LOSS) INCOME PER SHARE

Basic net (loss) income per share and diluted net (loss) income per share are presented for the three years presented.

The following table presents the calculation of weighted-average shares of common stock used in the computations of basic and diluted net (loss) income per share amounts presented in the accompanying consolidated statements of operations and comprehensive (loss) income (in thousands, except per share amounts):

	Years Ended December 31,		
	2022	2021	2020
Numerator:			
Net (loss) income	$ (314,248)	$ (181,223)	$ 29,403
Denominator:			
Basic			
Weighted-average shares used in computing basic net (loss) income per share	224,550	204,136	165,187
Basic net (loss) income per share	$ (1.40)	$ (0.89)	$ 0.18
Diluted			
Weighted-average shares used in computing basic net (loss) income per share	224,550	204,136	165,187
Add: weighted-average stock options	—	—	6,092
Add: weighted-average restricted stock units	—	—	2,324
Add: weighted-average common stock issuable pursuant to our ESPP	—	—	1,367
Weighted-average shares used in computing diluted net (loss) income per share	224,550	204,136	174,970
Diluted net (loss) income per share	$ (1.40)	$ (0.89)	$ 0.17

The following shares issuable upon conversion of convertible senior notes, options outstanding, time-based RSUs, performance-based RSUs, and ESPP shares to purchase common stock were excluded from the computation of diluted net loss per share for the periods presented because the effect of including such shares would have been antidilutive:

	Years Ended December 31,		
(in thousands)	2022	2021	2020
Shares issuable upon conversion of convertible senior notes	20,690	20,690	—
Options to purchase common stock	14,876	12,463	4,908
RSUs with time-based vesting	8,535	7,392	100
RSUs with performance-based vesting	—	—	94
ESPP shares	3,880	1,564	2,890

As described in *Note 2. Business Acquisitions*, the contingently issuable shares would be due upon the achievement of a milestone. See *Note 10. Stockholders' Equity* for detailed information on RSUs with time-based vesting and RSUs with performance-based vesting.

NOTE 12. SEGMENT AND GEOGRAPHIC INFORMATION

We are organized as, and operate in, one reportable segment: the development, manufacturing, and marketing of an integrated platform for genetic analysis. Our chief operating decision-maker is our Chief Executive Officer. The Chief Executive Officer reviews financial information presented on a consolidated basis for the purposes of evaluating financial performance and allocating resources, accompanied by information about revenue by geographic regions. Our assets are primarily located in the United States of America and not allocated to any specific region, and we do not measure the performance of geographic regions based upon asset-based metrics. Therefore, geographic information is presented only for revenue.

A summary of our revenue by geographic location is as follows:

	Years Ended December 31,		
(in thousands)	2022	2021	2020
Americas	$ 69,561	$ 64,521	$ 37,277
Europe, Middle East, and Africa	22,598	30,271	19,065
Asia-Pacific	36,145	35,721	22,551
Total	$ 128,304	$ 130,513	$ 78,893

A summary of our revenue by category is as follows:

	Years Ended December 31,		
(in thousands)	2022	2021	2020
Instrument revenue	$ 48,719	$ 61,324	$ 34,282
Consumable revenue	59,980	52,181	31,142
Product revenue	108,699	113,505	65,424
Service and other revenue	19,605	17,008	13,469
Total revenue	$ 128,304	$ 130,513	$ 78,893

NOTE 13. SUBSEQUENT EVENTS

On January 27, 2023, the Company issued and sold an aggregate of 20,125,000 shares of the Company's common stock at a purchase price of $10.00 per share pursuant to an automatic shelf registration statement filed on Form S-3 (File No. 333-249999) with the Securities and Exchange Commission, resulting in aggregate gross proceeds of approximately $201.3 million.

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

Our management, with the participation of our chief executive officer, our chief financial officer, and our principal accounting officer, evaluated the effectiveness of our disclosure controls and procedures (as defined in Rules 13a–15(e) and 15d–15(e) of the Exchange Act) as of the end of the period covered by this Annual Report on Form 10–K. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is accumulated and communicated to our management, including its principal executive and principal financial officers, as appropriate to allow timely decisions regarding required disclosure. Management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives, and management necessarily applies its judgement in evaluating the cost-benefit relationship of possible controls and procedures. Based on this evaluation, our chief executive officer, chief financial officer and our principal accounting officer concluded that our disclosure controls and procedures were effective as of the end of the period covered by this report.

Management's 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). Pacific Biosciences of California, Inc's internal control over financial reporting is designed to provide reasonable assurance to the Company's management and board of directors regarding the preparation and fair presentation of published financial statements. Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Therefore, even those systems determined to be effective can provide only reasonable assurance with respect to financial statement preparation and presentation. Management assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2022. In making this assessment, management used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) (the COSO criteria). Based on our assessment, we concluded that, as of December 31, 2022, the Company's internal control over financial reporting was effective based on those criteria.

The Company's internal control over financial reporting as of December 31, 2022 has been audited by Ernst &Young LLP, the independent registered public accounting firm who also audited the Company's financial statements. Ernst &Young's attestation report on the Company's internal control over financial reporting appears on page 91 hereof.

Changes in Internal Control Over Financial Reporting

There were no material changes in our internal control over financial reporting identified in connection with the evaluation required by Rule 13a-15(d) and 15d-15(d) of the Exchange Act that occurred during the year ended December 31, 2022, that have materially affected, or were reasonably likely to materially affect, our internal control over financial reporting.

Report of Independent Registered Public Accounting Firm

To the Stockholders and the Board of Directors of Pacific Biosciences of California, Inc.

Opinion on Internal Control over Financial Reporting

We have audited Pacific Biosciences of California, Inc.'s internal control over financial reporting as of December 31, 2022, 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, Pacific Biosciences of California, Inc. (the Company) maintained, in all material respects, effective internal control over financial reporting as of December 31, 2022, based on the COSO criteria.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the 2022 consolidated financial statements of the Company and our report dated February 28, 2023, 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 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
February 28, 2023

ITEM 9B. OTHER INFORMATION

None.

ITEM 9C. DISCLOSURE REGARDING FOREIGN JURISDICTIONS THAT PREVENT INSPECTIONS

Not applicable.

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

Information responsive to this item is incorporated herein by reference to our definitive proxy statement with respect to our 2023 Annual Meeting of Stockholders to be filed with the SEC within 120 days after the end of the fiscal year covered by this Annual Report on Form 10-K.

ITEM 11. EXECUTIVE COMPENSATION

Information responsive to this item is incorporated herein by reference to our definitive proxy statement with respect to our 2023 Annual Meeting of Stockholder to be filed with the SEC within 120 days after the end of the fiscal year covered by this Annual Report on Form 10-K.

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

Information responsive to this item is incorporated herein by reference to our definitive proxy statement with respect to our 2023 Annual Meeting of Stockholders to be filed with the SEC within 120 days after the end of the fiscal year covered by this Annual Report on Form 10-K.

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

Information responsive to this item is incorporated herein by reference to our definitive proxy statement with respect to our 2023 Annual Meeting of Stockholders to be filed with the SEC within 120 days after the end of the fiscal year covered by this Annual Report on Form 10-K.

ITEM 14. PRINCIPAL ACCOUNTANT FEES AND SERVICES

Information responsive to this item is incorporated herein by reference to our definitive proxy statement with respect to our 2023 Annual Meeting of Stockholders to be filed with the SEC within 120 days after the end of the fiscal year covered by this Annual Report on Form 10-K.

PART IV

ITEM 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES.

(a) The following documents are filed as part of, or incorporated by reference into, this Annual Report on Form 10-K:

1. *Financial Statements*: See Index to Consolidated Financial Statements under Item 8 of this Annual Report on Form 10-K.
2. *Financial Statement Schedules*: All schedules are omitted because they are not required, are not applicable or the information is included in the consolidated financial statements or notes thereto.
3. *Exhibits*: We have filed or incorporated by reference into this Annual Report on Form 10-K, the exhibits listed on the accompanying Exhibit Index immediately below.

(b) Financial Statement Schedules: See Item 15(a)(2), above.

(c) Exhibits: Refer to the Exhibit Index that follows.

Exhibit Index

Exhibit Number	Description	Incorporated by reference herein		
		Form	Exhibit No.	Filing Date
3.1	Amended and Restated Certificate of Incorporation	10-K	3.1	March 23, 2011
3.2	Third Amended and Restated Bylaws of Pacific Biosciences of California, Inc.	8-K	3.1	November 7, 2022
4.1	Specimen Common Stock Certificate	S-1/A	4.1	October 1, 2010
4.2	Description of Registrant's securities registered under Section 12 of the Exchange Act	10-K	4.2	February 28, 2020
4.3	Indenture, dated February 16, 2021, between Pacific Biosciences of California, Inc., and U.S. Bank National Association, as Trustee	8-K	4.1	February 17, 2021
4.4	Form of 1.50% Convertible Senior Notes due 2028 (included in Exhibit 4.3)	8-K	4.1	February 17, 2021
10.1+	Form of Director and Executive Officer Indemnification Agreement	S-1	10.1	August 16, 2010
10.2+	2010 Equity Incentive Plan	S-1	10.4	August 16, 2010
10.3+	2010 Equity Incentive Plan forms of agreement	10-Q	10.1	May 2, 2018
10.4+	2010 Employee Stock Purchase Plan and forms of agreement thereunder	S-1	10.5	August 16, 2010
10.5+	2010 Outside Director Equity Incentive Plan	S-1	10.6	August 16, 2010
10.6+	2010 Outside Director Equity Incentive Plan forms of agreement	10-Q	10.2	May 2, 2018
10.7+	2020 Equity Incentive Plan and related forms of agreement, as amended	8-K	10.1	May 26, 2022
10.8+	Form of Global Stock Option Agreement under the Pacific Biosciences of California, Inc., 2020	8-K	10.2	May 26, 2022
10.9+	Form of Global Restricted Stock Unit Agreement under the Pacific Biosciences of California, Inc. 2020 Equity Incentive Plan, as amended	8-K	10.3	May 26, 2022
10.10+	Omniome Equity Incentive Plan of Pacific Biosciences of California, Inc., and related forms of agreement thereunder	10-Q	10.4	November 5, 2021
10.11+	Pacific Biosciences of California, Inc. 2020 Inducement Equity Incentive Plan, as amended, and forms of agreement thereunder	8-K	10.1	November 19, 2021
10.12+	Letter Relating to Employment Terms by and between the Registrant and Susan G. Kim effective September 28, 2020	10-Q	10.2	November 3, 2020
10.13+	Form of Change in Control and Severance Agreement for executive officers	10-K	10.14	February 26, 2021
10.14+	Letter Relating to Employment Terms by and between the Registrant and Christian O. Henry effective September 14, 2020	10-K	10.15	February 26, 2021
10.15+	Amended Change in Control and Severance Agreement by and between the Registrant and Christian O. Henry dated February 3, 2021	10-K	10.17	February 26, 2021
10.16+	Letter Relating to Employment Terms by and between the Registrant and Mark Van Oene effective January 8, 2021	10-K	10.18	February 26, 2021
10.17+	Lease Agreement by and between the Registrant and Menlo Park Portfolio II, LLC, dated July 22, 2015	10-Q	10.2	August 5, 2015
10.18†	First Amendment to Lease Agreement by and between the Registrant and Menlo Park Portfolio II, LLC, dated December 23, 2016	10-K	10.50	March 6, 2017
10.19	Investment Agreement, dated as of February 9, 2021, between Pacific Biosciences of California, Inc. and SB Northstar LP.	8-K	10.1	February 10, 2021
10.20††	Exclusive License Agreement by and between the Registrant and Cornell Research Foundation, Inc., dated as of February 1, 2004	S-1/A	10.8	October 22, 2010
10.21+	Letter Relating to Employment Terms by and between the Registrant and Michele Farmer effective May 17, 2021	10-Q	10.2	August 6, 2021
10.22	Agreement and Plan of Merger of Reorganization among Pacific Biosciences of California, Inc., Apollo Acquisition Corp., Apollo Acquisition Sub, LLC, Omniome, Inc. and Shareholder Representative Services, LLC, as securityholder representative, dated as of July 19, 2021	8-K	10.1	July 20, 2021
10.23	Securities Purchase Agreement, dated as of July 19, 2021, by and between Pacific Biosciences of California, Inc., and each of the Investors	8-K	10.2	July 20, 2021
10.24	Registration Rights Agreement, dated as of July 19, 2021, by and between Pacific Biosciences of California, Inc., and each of the Investors	8-K	10.3	July 20, 2021
10.25+	Letter Relating to Employment Terms by and between the Registrant and Jeff Eidel effective August 16, 2022	8-K	99.3	January 24, 2023

10.26+	Change in Control and Severance Agreement by and between the Registrant and Susan G. Kim effective February 3, 2021	8-K	99.4	January 24, 2023
10.27	Form of Performance-Based Restricted Stock Unit Award Agreement under the Pacific Biosciences of California, Inc. 2020 Equity Incentive Plan, as amended			Filed herewith
21.1	List of Subsidiaries of the Registrant			Filed herewith
23.1	Consent of Independent Registered Public Accounting Firm			Filed herewith
31.1	Certification of Chief Executive Officer pursuant to Exchange Act Rules 13a-14(a) and 15d-14(a), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002			Filed herewith
31.2	Certification of Chief Financial Officer pursuant to Exchange Act Rules 13a-14(a) and 15d-14(a), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002			Filed herewith
32.1*	Certification of Chief Executive Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002			Furnished herewith
32.2*	Certification of Chief Financial Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002			Furnished herewith
101.INS	XBRL Instance Document (the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL 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 Labels Linkbase Document			Filed herewith
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document			Filed herewith
104	Cover Page Interactive File (formatted as inline XBRL and contained in Exhibit 101)			Filed herewith

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+ Indicates management contract or compensatory plan.

† Confidential treatment has been requested for portions of this exhibit. These portions have been omitted and have been filed separately with the Securities and Exchange Commission.

†† Certain confidential information contained in this Exhibit was omitted by means of marking such portions with brackets because the identified confidential information (i) is not material and (ii) would be competitively harmful if publicly disclosed.

* The certifications attached as Exhibit 32.1 and 32.2 that accompany this Annual Report on Form 10-K are deemed furnished and not filed with the Securities and Exchange Commission and are not to be incorporated by reference into any filing of Pacific Biosciences of California, Inc. under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, whether made before or after the date of this Annual Report on Form 10-K, irrespective of any general incorporation language contained in such filing.

ITEM 16. FORM 10-K SUMMARY

None.

Signatures

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, as amended, the Registrant has duly caused this Annual Report on Form 10-K to be signed on its behalf by the undersigned, thereunto duly authorized.

Pacific Biosciences of California, Inc.

Date: February 28, 2023

By: /s/ Christian O. Henry
Christian O. Henry
President and Chief Executive Officer

Date: February 28, 2023

By: /s/ Susan G. Kim
Susan G. Kim
Chief Financial Officer

Date: February 28, 2023

By: /s/ Michele Farmer
Michele Farmer
Vice President and Chief Accounting Officer

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below hereby constitutes and appoints Christian O. Henry, Susan G. Kim, Brett Atkins, and Michele Farmer, and each of them, as his or her true and lawful attorney-in-fact and agent, with full power of substitution and resubstitution, for each individual in any and all capacities, to sign any and all amendments to this Annual Report on Form 10-K, and to file the same, with all exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents, and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully for all intents and purposes as he or she might or could do in person, hereby ratifying and confirming all that said attorneys-in-fact and agents, or any of them, or the individual's substitute, may lawfully do or cause to be done by virtue hereof.

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

Signature	Title	Date
/s/ Christian O. Henry Christian O. Henry	Director, President and Chief Executive Officer (Principal Executive Officer)	February 28, 2023
/s/ Susan G. Kim Susan G. Kim	Chief Financial Officer (Principal Financial Officer)	February 28, 2023
/s/ Michele Farmer Michele Farmer	Vice President and Chief Accounting Officer (Principal Accounting Officer)	February 28, 2023
/s/ John F. Milligan John F. Milligan	Chairman of the Board of Directors	February 28, 2023
/s/ David Botstein David Botstein	Director	February 28, 2023
/s/ William W. Ericson William W. Ericson	Director	February 28, 2023
/s/ Hannah A. Valantine Hannah A. Valantine	Director	February 28, 2023
/s/ Randall S. Livingston Randall S. Livingston	Director	February 28, 2023
/s/ Marshall L. Mohr Marshall L. Mohr	Director	February 28, 2023
/s/ Kathy Ordoñez Kathy Ordoñez	Director	February 28, 2023
/s/ Lucy Shapiro Lucy Shapiro	Director	February 28, 2023

EXECUTIVE OFFICERS

Christian Henry
President and Chief Executive Officer

Mark Van Oene
Chief Operating Officer

Jeff Eidel
Chief Commercial Officer

Susan G. Kim
Chief Financial Officer

BOARD OF DIRECTORS

Christian Henry
President and Chief Executive Officer

John Milligan, PhD (chair)
Chairman of the Board of Directors

David Botstein, PhD
Former Chief Scientific Officer at Calico Life Sciences, L.L.C.

William Ericson
Founding Partner at Wildcat Venture Partners

Randy Livingston
VP for Business Affairs and Chief Financial Officer at Stanford University

Marshall Mohr
EVP, Global Business Services at Intuitive Surgical, Inc.

Kathy Ordoñez
Director and former Chief Commercial Officer

Lucy Shapiro, PhD
Professor of Cancer Research and Director of Molecular and Genetic Medicine at Stanford University's School of Medicine

Hannah A. Valantine, MD
Professor of Medicine (Cardiovascular) at the Stanford University Medical Center

For additional biographical information on our directors and executive officers, see the sections of our proxy statement captioned "Corporate Governance—Board of Directors and Committees of the Board" (starting on page 10) and "Executive Officers" (starting on page 29). A copy of our proxy statement is included with this annual report to stockholders.

CORPORATE COUNSEL

Wilson Sonsini Goodrich & Rosati
650 Page Mill Road
Palo Alto, California 94304

COMMON STOCK LISTING

The Nasdaq Global Select Market
Ticker symbol: PACB

TRANSFER AGENT AND REGISTRAR

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Providence, RI 02940-3078

By Courier:
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