Filed pursuant to Rule 424(b)(4)
Registration Nos. 333-231703 and 333-232211

PROSPECTUS

7,921,500 Shares

COMMON STOCK

Personalis, Inc. is offering 7,921,500 shares of its common stock. This is our initial public offering and no public market currently exists for shares of our common stock. The initial public offering price is $17.00 per share.

We have been approved to list our common stock on The Nasdaq Global Market under the symbol "PSNL."

We are an "emerging growth company" as defined under the U.S. federal securities laws and, as such, have elected to comply with certain reduced public company reporting requirements.

Investing in our common stock involves risks. See the section titled "Risk Factors" beginning on page 13 to read about factors you should consider before buying shares of our common stock.

PRICE $17.00 A SHARE

	Price to Public	Underwriting Discounts and Commissions(1)	Proceeds to Personalis
Per Share	*$17.00*	*$1.19*	*$15.81*
Total	*$134,665,500*	*$9,426,585*	*$125,238,915*

(1) See the section titled "Underwriters" for a description of the compensation payable to the underwriters.

At our request, the underwriters have reserved up to 333,333 shares of common stock for sale at the initial public offering price in a directed share program, to our non-employee directors. See the section titled "Underwriters—Directed Share Program."

We have granted the underwriters the right to purchase up to 1,188,225 additional shares of common stock to cover over-allotments.

The Securities and Exchange Commission and state securities regulators have not approved or disapproved of these securities or determined if this prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

The underwriters expect to deliver the shares of common stock to purchasers on June 24, 2019.

MORGAN STANLEY *BofA MERRILL LYNCH* *COWEN*

OPPENHEIMER & CO.

June 19, 2019.

TABLE OF CONTENTS

Through and including July 14, 2019 (the 25th day after the date of this prospectus), all dealers effecting transactions in these securities, whether or not participating in this offering, may be required to deliver a prospectus. This is in addition to a dealer's obligation to deliver a prospectus when acting as an underwriter and with respect to an unsold allotment or subscription.

We have not authorized anyone to provide you with any information or to make any representations other than those contained in this prospectus or in any free writing prospectuses we have prepared. We and the underwriters take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may give you. We are offering to sell, and seeking offers to buy, shares of our common stock only in jurisdictions where offers and sales are permitted. The information contained in this prospectus is accurate only as of the date of this prospectus, regardless of the time of delivery of this prospectus or of any sale of our common stock. Our business, financial condition, results of operations, and future growth prospects may have changed since that date.

For investors outside the United States: Neither we nor any of the underwriters have done anything that would permit this offering or possession or distribution of this prospectus in any jurisdiction where action for that purpose is required, other than in the United States. Persons outside of the United States who come into possession of this prospectus must inform themselves about, and observe any restrictions relating to, the offering of the shares of our common stock and the distribution of this prospectus outside of the United States.

PROSPECTUS SUMMARY

This summary highlights selected information contained elsewhere in this prospectus. This summary does not contain all of the information you should consider before investing in our common stock. You should read this entire prospectus carefully, including the sections titled "Risk Factors," "Management's Discussion and Analysis of Financial Condition and Results of Operations," and our consolidated financial statements and the related notes included elsewhere in this prospectus, before making an investment decision. Our fiscal year ends on December 31. Unless the context otherwise requires, all references in this prospectus to "we," "us," "our," "our company," and "Personalis" refer to Personalis, Inc.

PERSONALIS, INC.

Overview

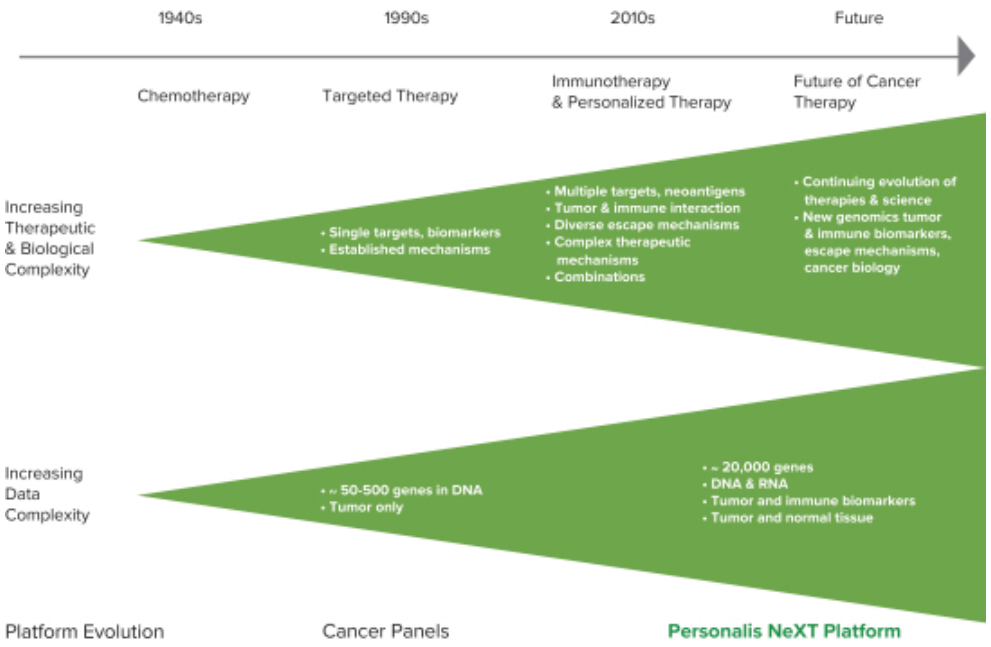
We are a growing cancer genomics company transforming the development of next-generation therapies by providing more comprehensive molecular data about each patient's cancer and immune response. We designed our NeXT Platform to adapt to the complex and evolving understanding of cancer, providing our biopharmaceutical customers with information on all of the approximately 20,000 human genes, together with the immune system, in contrast to many cancer panels that cover roughly 50 to 500 genes. We are also developing a complementary liquid biopsy assay that analyzes all human genes versus the more narrowly focused liquid biopsy assays that are currently available. By combining technological innovation, operational scale, and regulatory differentiation, our NeXT Platform is designed to help our customers obtain new insights into the mechanisms of response and resistance to therapy as well as new potential therapeutic targets. Our platform enhances the ability of biopharmaceutical companies to unlock the potential of conducting translational research in the clinic rather than with pre-clinical animal models or cancer cell lines. We are also planning to release a diagnostic based on our NeXT Platform that we envision being used initially by biopharmaceutical customers and clinical collaborators. Since inception, we have provided our services to more than 45 biopharmaceutical customers, including several of the largest pharmaceutical companies in the world.

In the past decade, the biopharmaceutical community has achieved major advances in the treatment of cancer, including approval of therapies capable of targeting specific genetic drivers of cancer and novel immunotherapies that empower the immune system to attack cancer cells. Despite these advances, the substantial majority of currently available cancer therapies have significant limitations, including efficacy only in certain subsets of patients, limited long-term survival rates, and significant toxicities. Moreover, the current research and development paradigm in oncology is beset by significant inefficiencies and substantial costs, with the average cost per patient in clinical trials reaching approximately $60,000. While tumor molecular profiling technologies have enhanced research and development efforts, most current tumor biopsy and liquid biopsy tests analyze a relatively narrow set of roughly 50 to 500 tumor genes, missing key genes and immune mechanisms underlying cancer therapy. With the lack of a comprehensive profiling solution, biopharmaceutical companies often attempt to use a disparate array of tests to compensate, resulting in a fragmented view of the tumor biology, insufficient tumor sample, logistical complexities, and increased costs. The resulting data heterogeneity makes it difficult to mine for new biological insights across cohorts of patients in clinical trials. These piecemeal approaches to tumor molecular profiling often result in solutions that are difficult to use at scale, especially in a clinical or therapeutic setting where simplicity, cost, turnaround time, and validation are important.

Our platform helps biopharmaceutical companies seeking to develop more efficacious therapies by comprehensively interrogating a patient's tumor and immune cells in detail, both to discover tumor vulnerabilities and elucidate potential therapeutic alternatives. To meet the demands of our customers, we built our NeXT Platform to be cost-effective and scalable with rapid turnaround times for tissue sample data and

analytics. NeXT represents the next step of our existing ACE platform, allowing customers to move up the value chain by gaining more information from a single sample. We believe that our platform has the potential to enable a research, development, and treatment paradigm that is dynamic and adaptive to the evolving genomic and immune system landscape of patients' tumors over time. We believe our technology will drive this evolving paradigm, which will enable our customers to develop safer and more efficacious therapeutics (see Figure 1). As the clinical utility of our platform increases, we expect to grow our diagnostic capabilities, including the ability to guide therapy based on a patient's changing tumor and immune system, supporting the commercialization of therapeutics developed by our biopharmaceutical customers.

Figure 1. Personalis NeXT Platform addresses the increasingly complex understanding of cancer.



Personalis: The Genomics Engine for Next-Generation Cancer Therapies

Biopharmaceutical customers use our comprehensive platform across a diverse set of therapeutic approaches to cancer. We generate and analyze data from patients who participated in clinical trials, which we believe will enable these customers to develop more effective therapies.

The information we generate is important to our customers developing three major classes of next-generation therapeutics: immunotherapies, targeted therapies, and personalized cancer therapies. Based on the approximately 195,000 patients who are currently expected to enroll in the over 1,600 immunotherapy, targeted therapy, and personalized therapy clinical trials that commenced in 2018, we estimate the total addressable market for multiple time point comprehensive tissue and liquid biopsy testing in clinical trials is over $5.0 billion annually. See the section titled "Market, Industry, and Other Data" for additional information regarding the data, sources, and assumptions we used for this estimate.

- **Immunotherapies:** Over the past decade, a number of drugs have emerged based on the discovery that the immune system plays a key role in addressing cancer. Checkpoint inhibitors, a specific type of immunotherapy, generated worldwide sales of over $16.6 billion in 2018, up from approximately

$1.4 billion in 2014. The commercial success of these drugs has shown the potential of immunotherapy; however, the development of new therapies in this category has been challenged by difficulties understanding the precise interaction between cancer and the immune system. The number of clinical trials in this space involving at least one cancer immunotherapy drug has grown from 123 that started in 2012 to 1,000 that started in 2018. Since our platform provides comprehensive insights on tumor and immune biology, including in both innate and adaptive immune cells, we believe it will enable biopharmaceutical companies to better understand how therapeutics are working in patients.

- **Targeted Therapies:** A growing category of successful cancer treatments consists of therapies that target specific genes or molecular mechanisms of cancer. These drugs are not designed to influence the immune system directly, but the success of immunotherapies has brought acknowledgment that the immune system has a significant effect on their efficacy. Many of these targeted therapies are proposed to be tested in combination with immunotherapies. These therapies have grown to represent a considerable share of the overall oncology therapeutics market today. Comprehensively understanding each patient's genomic and immune profile is critical to understanding which of these therapies a patient may respond to. We believe that more comprehensive coverage of all of the approximately 20,000 genes positions us competitively against existing cancer panels that cover roughly 50 to 500 genes. We are positioning our company to be a leading provider of the complex information that we believe will continue to inform the development of targeted cancer therapies.
- **Personalized Cancer Therapies:** Many biopharmaceutical companies are pursuing personalized cancer therapies, which are designed and manufactured, individually, for each patient based on genomic alterations in a given patient's tumor. While there are many potential approaches to developing these therapies including neoantigen-based vaccines and T-cell therapies, all of them can potentially benefit from the data and analytics that our platform can generate about a patient's tumor. Given the more than 700,000 cancer patients projected to be diagnosed with late-stage disease in the United States in 2019, we estimate that the total addressable market for our data and analytics for personalized cancer therapy could reach as much as $20 billion in the United States and as much as $40 billion worldwide. See the section titled "Market, Industry, and Other Data" for additional information regarding the data, sources, and assumptions we used for this estimate. Many of our customers have leveraged our U.S. Food and Drug Administration (the "FDA") Device Master File as a component of their investigational new drug ("IND") filings with the FDA. We anticipate that if drugs are approved that used our platform in the clinical trials forming the basis for approval, we may be able to derive revenue in connection with the sale of these drugs. We believe we are working with the majority of companies developing neoantigen-targeted personalized cancer therapies.

We anticipate that as the clinical utility of our platform is validated, we will have opportunities in connection with diagnostics and the commercialization of cancer therapeutics, which are significantly larger than our initial clinical-trial focused markets. Over time, we expect our biopharmaceutical customers and research collaborators to build evidence of clinical utility for our platform as a diagnostic for advanced cancer therapies. Separately, we are also acquiring samples and are building a database which will hold value for our biopharmaceutical customers and may ultimately allow us to discover new mechanisms of cancer treatment.

The NeXT Platform

Our NeXT Platform is designed to provide comprehensive analysis of both a tumor and its immune microenvironment from a single limited tissue sample. Our platform covers the deoxyribonucleic acid ("DNA") sequence of all of the approximately 20,000 human genes. We also report on the entire transcriptome of a tumor, which encompasses ribonucleic acid ("RNA") expression across the approximately 20,000 human genes, allowing us to more accurately determine which of the many genomic mutations might actually be driving tumor progression. Furthermore, our platform analyzes elements of the immune cells that have infiltrated a tumor both from the adaptive immune system and the innate immune system.

Given the practical challenges in obtaining high-quality tumor samples via biopsy, we have developed our platform to work with a limited tumor tissue sample. Biopharmaceutical companies face significant challenges in attempting to divide samples to ship to multiple service providers to perform different tests. If a biopharmaceutical company is successful in acquiring results from multiple service providers, it is challenging to compare the results across multiple data platforms from multiple service providers. Our platform is composed of multiple proprietary technologies, many of which we have developed from the ground up. The breadth of the assays that we have integrated into our platform, our proprietary sample preparation process, and the comprehensiveness of our platform allow us to maximize the utility of often limited tumor tissue samples that our customers have from their clinical trials.

We have also shown that our technology can analyze cell-free DNA ("cfDNA") obtained from blood plasma, also known as a liquid biopsy. As with a tissue biopsy, we plan to analyze all of the approximately 20,000 human genes in each plasma sample, in contrast to currently marketed liquid biopsy panels. We expect this cfDNA to be obtained by a blood draw concurrently with a tissue sample. Together, the two samples can be used to provide a more comprehensive initial characterization of the tumor. Additionally, we expect to monitor changes in tumor genetics that arise in response to therapy through serial measurements using cfDNA samples collected across multiple time points. In 2020, we plan to launch our first liquid biopsy assay designed to analyze all human genes so as to detect potential neoantigens and tumor escape mechanisms that arise under therapeutic pressure. Although we believe our cfDNA test will offer new insights, we believe it will be most useful for our biopharmaceutical customers alongside our primary tumor biopsy product, given that a tumor biopsy is required to analyze gene expression and elucidate tumor-infiltrating lymphocytes, which are critical to understanding cancer's interaction with the immune system.

Robust Operational Infrastructure to Scale with Our Customers

We have invested significant resources to develop an operational infrastructure that allows us to easily customize our services for each of our customers and scale rapidly to meet their potential research and commercial demands. Our NeXT Platform is complemented by our enterprise-grade software and bespoke information management systems that we tailor to meet our customers' unique needs and integrate with their workflows. Moreover, our infrastructure provides customers with visibility and control over processes, ensures consistency across all components used for the duration of each clinical trial, is traceable for compliance purposes, and allows us to scale while maintaining rapid turnaround times.

We designed our proprietary informatics system, the Symphony Enterprise Informatics System ("Symphony"), as a flexible and scalable enterprise-grade system used to manage the unique complexities and challenges of our genomics laboratory. Symphony integrates laboratory information management systems and bioinformatics systems to connect laboratory operations with downstream data analysis. Symphony orchestrates all operational activities from our laboratory starting with sample receipt to the reporting of results of the genomic profiling and data delivery. We also use machine learning and artificial intelligence approaches to generate substantial performance advantages for our algorithms, such as neoantigen binding prediction.

We are sequencing and analyzing up to 100 trillion bases of DNA per week in our facility. We believe this capacity is already larger than most cancer genomics companies and we are building the automation and other infrastructure to scale further as demand increases and in support of the planned 2020 launch of our NeXT liquid biopsy assay.

Since 2012, we have been contracted to provide DNA sequencing and data analysis services to the U.S. Department of Veterans Affairs' (the "VA") Million Veteran Program (the "VA MVP"). The VA MVP began collecting samples in 2011 and is a landmark research effort aimed at better understanding how genetic variations affect health. Up to a million veterans are expected to enroll in the VA MVP study by 2021. With approximately

750,000 enrollees to date, the VA MVP exceeds the enrollment numbers of any single VA study or research program in the past, and is in fact one of the largest research cohorts of its kind. In September 2017, we entered into a one-year contract with three one-year renewal option periods with the VA for the VA MVP, and received orders under this contract in September 2017 and 2018. This relationship with the VA MVP has enabled us to innovate, scale our operational infrastructure, and achieve greater efficiencies in our lab. It has also supported our development of industry-leading, large-scale cancer genomic testing. The substantial experience that we have and expect to continue to develop in whole genome sequencing also optimally positions us for what we anticipate to be the longer-term strategic direction of the cancer genomics industry, which may include whole genome sequencing of tumors.

We believe our platform is well positioned to scale rapidly and substantially as the field of personalized cancer therapies matures. We believe that our platform could be essential to the composition and manufacture of any personalized cancer therapy developed using our platform. Furthermore, we expect that patients would be tested at multiple time points during the course of treatment: first to design a therapy according to an initial genomic profile generated from a tissue and/or liquid biopsy, and then as follow-up testing via liquid biopsy to detect any changes that would require therapy modifications after initial therapeutic interventions. If a therapy that uses our NeXT Platform achieves regulatory approval, we believe that our commercial opportunity may increase substantially.

Personalis is Valuable to Biopharmaceutical Companies

We believe that our platform is valuable to our customers because:

- **Our tumor and immune molecular profiling capabilities provide an unprecedented breadth of data from a single limited tumor sample.** We provide information on all of the approximately 20,000 human genes, as well as gene expression, the immune system, and other elements of cancer biology, in contrast to other currently marketed panels that cover a limited range of roughly 50 to 500 genes and do not focus on immune cells.
- **Our platform enhances the opportunity to conduct translational research by analyzing tumor tissues from patients in clinical trials, rather than animal models or in vitro cancer cell lines, which have historically limited cancer research.** While conventional pre-clinical model systems, such as animal models and cancer cell lines, have been instrumental in early-stage cancer research and drug development, translation of results to the clinic has been limited and remains a significant barrier to progress, in part because these models do not sufficiently reflect the complexity of human cancer and the human immune system. Over recent years, tools used to study tissue from patients have improved and the utilization of tissue from trials has increased. We believe our platform represents the next step in this transition by further enabling biopharmaceutical companies to address the historical limitations of analyzing patient tissue comprehensively.
- **The information we provide to personalized cancer therapy companies can be used to design therapeutics.** Many biopharmaceutical companies are pursuing personalized cancer therapies, which are designed and manufactured, individually, for each patient based on genomic alterations in a given patient's tumor. While there are many potential approaches to developing these therapies including neoantigen-based vaccines and T-cells therapies, all of them can potentially benefit from the data and analytics that our platform can generate about a patient's tumor.
- **Our enterprise-grade operational infrastructure is scalable, enables rapid turnaround times, and is tailored to meet the unique workflow needs of our customers.** We have invested significant resources to develop an operational infrastructure that allows us to easily customize our services for each of our customers and scale rapidly to meet their potential research and commercial demands.

- **We are developing a complementary liquid biopsy test, which also offers broad 20,000-gene coverage versus more narrowly focused liquid biopsy tests that are currently available.** While tumor biopsies are necessary to provide tumor immune microenvironment and gene expression information that current liquid biopsy panels do not provide, we believe a comprehensive liquid biopsy test used in concert with our tissue test can provide complementary information across multiple time points.

Our Strategy

Our mission is to transform the development of next generation cancer therapies by providing more comprehensive molecular data about each patient's tumor. To achieve this mission, our strategy is to:

- **Drive adoption of our platform by establishing and expanding relationships with leading developers of oncology therapeutics;**
- **Invest in new product innovations and enhancements to maintain our leading position;**
- **Continue to build a body of evidence demonstrating the utility of comprehensive genomic data;**
- **Continue to grow our relationship with the VA MVP to innovate and scale our operational infrastructure;**
- **Leverage a growing body of evidence from our platform to develop a diagnostic; and**
- **Build out a comprehensive tumor-genomics database.**

Our Team

We have assembled a multidisciplinary team of experienced industry leaders to drive continuous innovation. Scientific and operational excellence is a guiding principle for our employees. We have invested not only in the technology to provide information of sufficient quality for clinical use, but also in the people to continuously innovate for the industry's growing and changing demands.

Our President and Chief Executive Officer, John West, co-founded our company in 2011 in conjunction with four Stanford professors, Euan Ashley, M.D., Ph.D., Atul Butte, M.D., Ph.D., Russ Altman, M.D., Ph.D., and Michael Snyder, Ph.D. More broadly, our executive officers and management team members have had previous experience at a variety of genomics, pharmaceuticals, biotechnology, diagnostics, data analytics, service, enterprise software, and technology companies including Agilent Technologies, Inc., Applied Biosystems Inc., ARMO Biosciences, Inc., Illumina, Inc., Informatica LLC, Ingenuity Systems, Inc., Lumentum Holdings Inc., Merck & Co., Inc., Molecular Dynamics, Inc., Natera, Inc., Novartis Pharmaceuticals Corp., Pacific Biosciences of California, Inc., RainDance Technologies, Inc., and Solexa, Ltd.

Financial Highlights

Our revenues have grown rapidly as our penetration of clinical trials in advanced oncology therapeutics has expanded, consistent with our reputation as a leader in the field. We generated revenues of $9.4 million, $37.8 million, and $14.1 million for the years ended December 31, 2017 and 2018 and the three months ended March 31, 2019, respectively. We also incurred net losses of $23.6 million, $19.9 million, and $5.7 million for the years ended December 31, 2017 and 2018 and the three months ended March 31, 2019, respectively.

As of March 31, 2019, we had $33.2 million of cash and cash equivalents, an increase of $11.4 million from March 31, 2018. Our revenues are primarily generated through sales of our services to biopharmaceutical companies and the VA MVP. Unlike diagnostic or therapeutic companies, we have not sought reimbursement through traditional healthcare payors. We have raised $89.6 million in preferred stock equity financing to date.

Risk Factors Summary

Investing in our common stock involves numerous risks, including the risks described in the section titled "Risk Factors" and elsewhere in this prospectus. You should carefully consider these risks before making an investment. The following are some of these risks, any of which could have an adverse effect on our business financial condition, operating results, or prospects.

- We have a history of losses, and as our costs increase, we expect to incur significant losses for the foreseeable future and may not be able to generate sufficient revenue to achieve or sustain profitability.
- If we are unable to increase sales of our current services or successfully develop and commercialize other services, our revenues will be insufficient for us to achieve profitability.
- Certain of our customers prepay us for a portion of the services that they expect to order from us in the future, and we may be required to refund some or all of those prepayments if a customer cancels its contract with us or reduces the level of services that it expects to receive.
- If we are unable to execute our sales and marketing strategy for our services and are unable to gain sufficient acceptance in the market, we may be unable to generate sufficient revenue to sustain our business.
- If we cannot compete successfully with our competitors, we may be unable to increase or sustain our revenues or achieve and sustain profitability.
- Our inability to raise additional capital on acceptable terms in the future may limit our ability to continue to operate our business and further expand our operations.
- We will need to invest in our infrastructure in advance of increased demand for our services, and our failure to accurately forecast demand would have a negative impact on our business and our ability to achieve and sustain profitability.
- We have substantial customer concentration, with a limited number of customers accounting for a substantial portion of our 2018 revenues and accounts receivable.
- Our tests may be subject to regulatory action if regulatory agencies determine that our tests do not appropriately comply with statutory and regulatory requirements enforced by the FDA and/or CLIA requirements for quality laboratory testing.
- Litigation or other proceedings or third-party claims of intellectual property infringement, misappropriation or other violations may require us to spend significant time and money, and could in the future prevent us from selling our tests or impact our stock price, any of which could have a material adverse effect.
- We have identified a material weakness in our internal control over financial reporting and may identify additional material weaknesses in the future or otherwise fail to maintain an effective system of internal controls, which may result in material misstatements of our financial statements or cause us to fail to meet our periodic reporting obligations.
- Insiders will exercise significant control over our company and will be able to influence corporate matters.

Corporate Information

We were incorporated under the laws of the state of Delaware in February 2011 under the name Personalis, Inc. Our principal executive offices are located at 1330 O'Brien Drive, Menlo Park, California 94025. Our telephone number is (650) 752-1300. Our website address is https://www.personalis.com. Information contained on, or that can be accessed through, our website is not incorporated by reference into this prospectus, and you should not consider information on our website to be part of this prospectus.

Personalis, the Personalis logo, and our other registered or common law trade names, trademarks, or service marks appearing in this prospectus are the property of Personalis, Inc. Trade names, trademarks, and service marks of other companies appearing in this prospectus are the property of their respective owners.

Implications of Being an Emerging Growth Company

As a company with less than $1.07 billion in revenues during our last fiscal year, we qualify as an "emerging growth company" as defined in the Jumpstart Our Business Startups Act (the "JOBS Act"), enacted in April 2012. An emerging growth company may take advantage of reduced reporting requirements that are otherwise applicable to public companies. These provisions include, but are not limited to:

- not being required to comply for a certain period of time with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, as amended;
- reduced disclosure obligations regarding executive compensation in our periodic reports, proxy statements, and registration statements; and
- exemptions from the requirements of holding a stockholder advisory vote on executive compensation and any golden parachute payments not previously approved.

We may take advantage of these provisions until the last day of our fiscal year following the fifth anniversary of the date of the first sale of our common stock in this offering. However, if certain events occur prior to the end of such five-year period, including if (i) we become a "large accelerated filer," with at least $700 million of equity securities held by non-affiliates; (ii) our annual gross revenues exceed $1.07 billion; or (iii) we issue more than $1.0 billion of non-convertible debt in any three-year period, we will cease to be an emerging growth company prior to the end of such five-year period.

We have elected to take advantage of certain of the reduced disclosure obligations in the registration statement of which this prospectus is a part and may elect to take advantage of other reduced reporting requirements in future filings. As a result, the information that we provide to our stockholders may be different than you might receive from other public reporting companies in which you hold equity interests.

In addition, the JOBS Act provides that an emerging growth company can take advantage of an extended transition period for complying with new or revised accounting standards. This provision allows an emerging growth company to delay the adoption of some accounting standards until those standards would otherwise apply to private companies. We have irrevocably elected not to avail ourselves of this exemption and, therefore, we will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

THE OFFERING

Common stock offered by us	7,921,500 shares
Common stock to be outstanding after this offering	29,751,201 shares
Over-allotment option to purchase additional shares	1,188,225 shares
Use of proceeds	We estimate that the net proceeds from the sale of our common stock in this offering will be approximately $122.0 million (or approximately $140.8 million if the underwriters exercise their over-allotment option in full), based on the initial public offering price of $17.00 per share and after deducting underwriting discounts and commissions and estimated offering expenses payable by us. The principal purposes of this offering are to increase our capitalization and financial flexibility and create a public market for our common stock. We currently intend to use the net proceeds we receive from this offering for expanded research and development, infrastructure expansion, facilities expansion, headcount growth, sales and marketing expenditures, public company costs, other capital expenditures, and working capital. See the section titled “Use of Proceeds” for additional information.
Risk factors	See the section titled “Risk Factors” for additional information.
Directed share program	At our request, the underwriters have reserved up to 333,333 shares of common stock for sale at the initial public offering price through a directed share program to our non-employee directors. The sales will be made at our direction by Morgan Stanley & Co. LLC and its affiliates through a directed share program. The number of shares of our common stock available for sale to the general public in this offering will be reduced to the extent that such persons purchase such reserved shares. Any reserved shares not so purchased will be offered by the underwriters to the general public on the same terms as the other shares of common stock offered by this prospectus. Any of our non-employee directors that participate in this directed share program will be subject to lockup and market standoff restrictions with the underwriters and with us with respect to any shares purchased through the directed share program. For additional information, see the section titled “Underwriters—Directed Share Program.”
Trading symbol on The Nasdaq Global Market	“PSNL”

The number of shares of our common stock that will be outstanding after this offering is based on 21,829,701 shares of our common stock (including shares of our redeemable convertible preferred stock on an as-converted basis, and assuming the exercise of a warrant to purchase 188,643 shares of our common stock) outstanding as of March 31, 2019, and excludes:

- 4,381,884 shares of our common stock issuable upon the exercise of options to purchase shares of our common stock granted under our 2011 Equity Incentive Plan (the "2011 Plan"), and outstanding as of March 31, 2019, with a weighted-average exercise price of $3.62 per share;
- 363,440 shares of our common stock issuable upon the exercise of options to purchase shares of our common stock granted under our 2011 Plan after March 31, 2019, with an exercise price of $13.20 per share;
- 84,585 shares of our redeemable convertible preferred stock issuable upon the exercise of warrants to purchase shares of our redeemable convertible preferred stock outstanding as of March 31, 2019, with a weighted-average exercise price of $7.13 per share;
- 65,502 shares of our common stock issuable upon the exercise of a warrant to purchase shares of our common stock outstanding as of March 31, 2019, with an exercise price of $9.16 per share;
- 7,440,524 shares of our common stock reserved for future issuance under our 2019 Equity Incentive Plan (the "2019 Plan"), (including up to 5,440,524 shares of our common stock comprised of (i) the shares reserved and remaining available for issuance under our 2011 Plan that will be added to our 2019 Plan reserve upon its effectiveness plus (ii) the number of shares subject to stock options or other stock awards granted under our 2011 Plan that would have otherwise returned to our 2011 Plan, which will be added as they become available (e.g., due to forfeiture of the underlying 2011 Plan award)) which includes an annual evergreen increase and will become effective in connection with this offering; and
- 250,000 shares of our common stock reserved for future issuance under our 2019 Employee Stock Purchase Plan (the "ESPP"), which includes an annual evergreen increase and will become effective in connection with this offering.

Unless otherwise indicated, the information in this prospectus assumes:

- the automatic conversion of all outstanding shares of our redeemable convertible preferred stock into 18,474,742 shares of our common stock immediately prior to the closing of this offering;
- a four-for-one reverse stock split of our common stock and redeemable convertible preferred stock, which was effected on June 4, 2019 (all share and per share amounts in this prospectus have been presented in a retrospective basis to reflect the reverse stock split);
- no exercise of the outstanding options described above;
- the cash exercise of an outstanding warrant to purchase 188,643 shares of our common stock;
- no exercise of the outstanding warrants to purchase shares of our redeemable convertible preferred stock described above and the automatic conversion of such warrants into warrants exercisable for 84,585 shares of our common stock;
- no exercise of an outstanding warrant to purchase 65,502 shares of our common stock described above;
- no exercise of the underwriters' option to purchase up to an additional 1,188,225 shares of common stock to cover over-allotments; and
- the filing and effectiveness of our amended and restated certificate of incorporation and the adoption of our amended and restated bylaws, each of which will occur prior to the closing of this offering.

SUMMARY CONSOLIDATED FINANCIAL DATA

The summary consolidated statements of operations data for the years ended December 31, 2017 and 2018 has been derived from our audited consolidated financial statements included elsewhere in this prospectus. The summary consolidated statements of operations and comprehensive loss data for the three months ended March 31, 2018 and 2019 and the summary consolidated balance sheet data as of March 31, 2019 are derived from our unaudited interim condensed consolidated financial statements included elsewhere in this prospectus. We have prepared the unaudited interim condensed consolidated financial statements on the same basis as the audited financial statements and have included, in our opinion, all adjustments, consisting only of normal recurring adjustments that we consider necessary for a fair statement of the financial information set forth in those statements. You should read the consolidated financial data set forth below in conjunction with our consolidated financial statements and the accompanying notes and the information in the section titled "Management's Discussion and Analysis of Financial Condition and Results of Operations" contained elsewhere in this prospectus. Our historical results are not necessarily indicative of the results that may be expected for any other period in the future and our interim results for the three months ended March 31, 2019 are not necessarily indicative of results to be expected for the full year ending December 31, 2019, or any other period.

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
	(in thousands, except share and per share data)			
Consolidated Statements of Operations Data:				
Revenues	$ 9,393	$ 37,774	$ 4,164	$ 14,075
Costs and expenses				
Costs of revenues(1)	11,736	25,969	4,065	10,091
Research and development(1)	9,919	14,304	2,949	5,245
Selling, general, and administrative(1)	9,901	11,271	2,313	4,170
Total costs and expenses	31,556	51,544	9,327	19,506
Loss from operations	(22,163)	(13,770)	(5,163)	(5,431)
Interest income	100	293	61	84
Interest expense	(1,303)	(1,894)	(622)	(184)
Loss on debt extinguishment	—	(4,658)	—	—
Other (expense) income, net	(227)	150	351	(152)
Loss before income taxes	(23,593)	(19,879)	(5,373)	(5,683)
Provision for income taxes	(5)	(7)	(2)	(2)
Net loss	$ (23,598)	$ (19,886)	$ (5,375)	$ (5,685)
Net loss per share, basic and diluted(2)	$ (7.78)	$ (6.49)	$ (1.76)	$ (1.84)
Weighted-average shares outstanding, basic and diluted(2)	3,031,636	3,063,157	3,051,581	3,091,342
Pro forma net loss per share, basic and diluted (unaudited)(2)		$ (0.95)		$ (0.26)
Pro forma weighted-average shares outstanding, basic and diluted (unaudited)(2)		20,483,543		21,754,727

(1) Includes stock-based compensation as follows:

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
	(in thousands)			
Costs of revenues	$ 74	$ 177	$ 24	$ 85
Research and development	225	429	64	164
Selling, general, and administrative	454	711	81	360
Total stock-based compensation expense	$ 753	$ 1,317	$ 169	$ 609

(2) See the consolidated statements of operations and Note 15 to our consolidated financial statements included elsewhere in this prospectus for an explanation of the method used to compute the historical and pro forma net loss per share and the number of shares used in the computation of the per share amounts.

	As of March 31, 2019		
	Actual	Pro Forma(1)	Pro Forma as Adjusted(2)
		(unaudited) (in thousands)	
Consolidated Balance Sheet Data:			
Cash and cash equivalents	$ 33,237	$ 33,245	$ 155,284
Working capital(3)	(15,348)	(15,340)	106,699
Total assets	57,647	57,655	179,694
Redeemable convertible preferred stock warrant liability	817	—	—
Additional paid-in capital	10,666	101,784	223,822
Accumulated deficit	(121,190)	(122,080)	(122,080)
Total stockholders' equity (deficit)	(110,523)	(20,294)	101,745

(1) The pro forma consolidated balance sheet data gives effect to (i) the automatic conversion of all of our outstanding shares of redeemable convertible preferred stock as of March 31, 2019 into 18,474,742 shares of our common stock immediately prior to the closing of this offering, (ii) the assumed cash exercise of a warrant to purchase 188,643 shares of our common stock, (iii) the automatic conversion of two warrants to purchase an aggregate of 84,585 shares of our redeemable convertible preferred stock, outstanding as of March 31, 2019, into warrants to purchase an equivalent number of shares of our common stock, and the related reclassification of redeemable convertible preferred stock warrant liability to stockholders' equity, (iv) stock-based compensation expense of $0.9 million associated with outstanding stock options subject to a performance condition for which the service-based vesting condition was satisfied as of March 31, 2019 and which we will recognize in connection with this offering, and (v) the filing and effectiveness of our amended and restated certificate of incorporation that will be in effect immediately prior to the closing of this offering. For additional information, see Note 1 to our consolidated financial statements included elsewhere in this prospectus.

(2) The pro forma as adjusted consolidated balance sheet data gives effect to (i) the pro forma items described in footnote (1) above and (ii) the issuance and sale by us of 7,921,500 shares of our common stock in this offering at the initial public offering price of $17.00 per share, after deducting the underwriting discounts and commissions and estimated offering expenses payable by us and the use of proceeds to satisfy the withholding tax obligations described in the footnote above.

(3) Working capital is defined as total current assets less total current liabilities. See our consolidated financial statements and the related notes included elsewhere in this prospectus for further details regarding our current assets and current liabilities.

RISK FACTORS

Investing in our common stock involves a high degree of risk. You should consider and read carefully all of the risks and uncertainties described below, as well as other information included in this prospectus, including our consolidated financial statements and related notes appearing at the end of this prospectus, before making an investment decision. The occurrence of any of the following risks or additional risks and uncertainties not presently known to us or that we currently believe to be immaterial could materially and adversely affect our business, financial condition, or results of operations. In such case, the trading price of our common stock could decline, and you may lose all or part of your original investment. This prospectus also contains forward-looking statements and estimates that involve risks and uncertainties. Our actual results could differ materially from those anticipated in the forward-looking statements as a result of specific factors, including the risks and uncertainties described below.

Risks Related to Our Business and Strategy

We have a history of losses, and as our costs increase, we expect to incur significant losses for the foreseeable future and may not be able to generate sufficient revenue to achieve or sustain profitability.

We have incurred net losses since our inception. For the years ended December 31, 2017 and 2018 and the three months ended March 31, 2019, we had net losses of $23.6 million, $19.9 million, and $5.7 million, respectively. As of March 31, 2019, we had an accumulated deficit of $121.2 million. To date, we have not generated sufficient revenue to achieve profitability, and we may never achieve or sustain profitability. In addition, we expect to continue to incur net losses for the foreseeable future, and we expect our accumulated deficit to continue to increase as we focus on scaling our business and operations. Our efforts to sustain and grow our business may be more costly than we expect, and we may not be able to increase our revenue sufficiently to offset our higher operating expenses. Our prior losses and expected future losses have had and will continue to have an adverse effect on our stockholders' equity and working capital. Our failure to achieve and sustain profitability in the future would negatively affect our business, financial condition, results of operations, and cash flows, and could cause the market price of our common stock to decline.

If we are unable to increase sales of our current services or successfully develop and commercialize other services or products, our revenues will be insufficient for us to achieve profitability.

We currently derive substantially all of our revenues from sales of our services. We began offering our services through our Clinical Laboratory Improvement Amendments of 1988 ("CLIA")-certified, College of American Pathologists ("CAP")-accredited, and state-licensed laboratory in 2013. We are in varying stages of research and development for other services and products that we may offer. If we are unable to increase sales of our existing services or successfully develop and commercialize other services and products, we will not generate sufficient revenues to become profitable.

Certain of our customers prepay us for a portion of the services that they expect to order from us in the future and we may be required to refund some or all of those prepayments if a customer cancels its contract with us or reduces the level of services that it expects to receive.

Certain of our customers prepay us for a portion of the services that they expect to order from us before they place purchase orders and we deliver those services. In some cases, this prepayment can be substantial and may be paid months or a year or more in advance of these customers providing samples to us and before our delivery of the services to which some or all of the deposit relates. As of March 31, 2019, we had approximately $44.3 million in customer deposits, including $39.6 million from one customer. However, as of that date, we had only $33.2 million of cash and cash equivalents. We are generally not required by our contracts to retain these

deposits in cash or otherwise and we have generally used these deposits to make capital expenditures and fund our operations. If a customer that has prepaid us for future services cancels its contract with us or reduces the level of services that it expects to receive, we would generally be required to repay that customer's deposit with little or no notice. We may not have the cash or other available resources to satisfy that repayment obligation. Even if we are able to satisfy the repayment obligation from available resources (including potentially a portion of the net proceeds of this offering), we may need to seek additional sources of capital to fund our operations, which funding may not be available when needed or on acceptable terms. In either of those circumstances, our business, financial condition, results of operations, and reputation would be materially and adversely affected. Furthermore, in the future customers may elect not to prepay us for our services in which case we would have to find other sources of funding for our capital expenditures and operations, which would be costly relative to the aforementioned cost-free customer deposit funding and which may not be available when needed or on acceptable terms.

If we are unable to execute our sales and marketing strategy for our services and are unable to gain sufficient acceptance in the market, we may be unable to generate sufficient revenues to sustain our business.

We are a growing genomics company and have engaged in targeted sales and marketing activities for our services. Although we have had revenues from sales of our services since 2013, our services may never gain significant acceptance in the marketplace and therefore may never generate substantial revenues or permit us to become profitable. We will need to further establish and grow the market for our services through the expansion of our current relationships and development of new relationships with biopharmaceutical customers. Gaining acceptance in medical communities can be supported by, among other things, publications in leading peer-reviewed journals of results from studies using our services. The process of publication in leading medical journals is subject to a peer review process and peer reviewers may not consider the results of our studies sufficiently novel or worthy of publication. Failure to have our studies published in peer-reviewed journals would limit the adoption of our services.

Our ability to successfully market our services that we have developed, and may develop in the future, will depend on numerous factors, including:

- our ability to demonstrate the utility and value of our services to our customers;
- the success of our sales force;
- whether biopharmaceutical companies accept that our services are sufficiently sensitive and specific;
- our ability to convince biopharmaceutical companies of the utility of the comprehensiveness of our services and of testing patients at multiple time points;
- our ability to continue to fund sales and marketing activities;
- whether our services are considered superior to those of our competitors;
- any negative publicity regarding our or our competitors' services resulting from defects or errors;
- our success obtaining and maintaining patent and trade secret protection for our services and technologies; and
- our success enforcing and defending intellectual property rights and claims.

Failure to achieve broad market acceptance of our services would materially harm our business, financial condition, and results of operations.

If we cannot compete successfully with our competitors, we may be unable to increase or sustain our revenues or achieve and sustain profitability.

Our principal competition comes from commercial and academic organizations using established and new laboratory tests to produce information that is similar to the information that we generate for our customers.

These commercial and academic organizations may not utilize our services or may not believe them to be superior to those tests that they currently use or others that are developed. Further, it may be difficult to convince our customers to use our comprehensive test rather than simpler panels provided by our competitors. For example, the information that we provide may be more challenging or require additional resources for our customers to interpret than the information provided by our competitors' less comprehensive assays.

Some of our present and potential competitors, including Guardant Health, Inc., Foundation Medicine, Inc., which was acquired by Roche Holdings, Inc. in July 2018, Roche Molecular Systems, Inc., NanoString Technologies, Inc., Personal Genome Diagnostics, Inc., and Adaptive Biotechnologies Corporation, may have widespread brand recognition and substantially greater financial and technical resources and development, production capacities, and marketing capabilities than we do. They may be able to devote greater resources to the development, promotion, and sale of their products and services than we do or sell their products and services at prices designed to win significant levels of market share. In addition, competitors may be acquired by, receive investments from, or enter into other commercial relationships with larger, well-established, and well-financed companies. Others may develop lower-priced, less complex products and services that pharmaceutical companies could view as functionally equivalent to our current or planned future services, which could force us to lower the price of our services and impact our operating margins and our ability to achieve and maintain profitability. In addition, companies or governments that control access to genetic testing and related services through umbrella contracts or regional preferences could promote our competitors or prevent us from performing certain services. In addition, technological innovations that result in the creation of enhanced products or diagnostic tools that are more sensitive or specific than ours may enable other clinical laboratories, hospitals, physicians, or medical providers to provide specialized products or services similar to ours in a more patient-friendly, efficient, or cost-effective manner than is currently possible. If we cannot compete successfully against current or future competitors, we may be unable to ensure or increase market acceptance and sales of our current or planned future services, which could prevent us from increasing or sustaining our revenues or achieving or sustaining profitability.

We expect that biopharmaceutical companies will increasingly focus attention and resources on the targeted and personalized cancer diagnostic sector as the potential and prevalence of molecularly targeted oncology therapies approved by the U.S. Food and Drug Administration (the "FDA") along with companion diagnostics increases. For example, the FDA has approved several such targeted oncology therapies that use companion diagnostics, including the anaplastic lymphoma kinase FISH test from Abbott Laboratories, Inc. for use with Xalkori® from Pfizer Inc., the BRAF kinase V600 mutation test from Roche Molecular Systems, Inc. for use with Zelboraf® from Daiichi-Sankyo/Genentech/Roche, and the BRAF kinase V600 mutation test from bioMerieux for use with Tafinlar® from GlaxoSmithKline. Since companion diagnostic tests are part of FDA labeling, non-FDA cleared tests, such as the ones we currently offer as part of our services, would be considered an off-label use and this may limit our access to this market segment.

Additionally, projects related to cancer diagnostics and particularly genomics have received increased government funding, both in the United States and internationally. As more information regarding cancer genomics becomes available to the public, we anticipate that more products aimed at identifying targeted treatment options will be developed and that these products may compete with our services. In addition, competitors may develop their own versions of our current or planned future services in countries where we did not apply for or receive patents and compete with us in those countries, including encouraging the use of their products or services by biopharmaceutical companies in other countries.

Our inability to raise additional capital on acceptable terms in the future may limit our ability to continue to operate our business and further expand our operations.

We expect capital expenditures and operating expenses to increase over the next several years as we continue to operate our business and expand our infrastructure, commercial operations, and research and development activities. Additionally, if we decide to grow our business by developing in vitro diagnostic tests,

our capital expenditures and operating expenses would significantly increase. We may seek to raise additional capital through equity offerings, debt financings, collaborations, or licensing arrangements. Additional funding may not be available to us on acceptable terms, or at all.

The various ways we could raise additional capital carry potential risks. If we raise funds by issuing equity securities, dilution to our stockholders would result. Any equity securities issued may also provide for rights, preferences, or privileges senior to those of holders of our common stock. In addition, the issuance of additional equity securities by us, or the possibility of such issuance, may cause the market price of our common stock to decline. If we raise funds by issuing debt securities, those debt securities would have rights, preferences, and privileges senior to those of holders of our common stock. The terms of debt securities issued or borrowings pursuant to a credit agreement, if available, could impose significant restrictions on our operations. The incurrence of additional indebtedness or the issuance of certain equity securities could result in increased fixed payment obligations and could also result in restrictive covenants, such as limitations on our ability to incur additional debt or issue additional equity, limitations on our ability to acquire or license intellectual property rights, and other operating restrictions that could adversely affect our ability to conduct our business. In the event that we enter into collaborations or licensing arrangements to raise capital, we may be required to accept unfavorable terms. These agreements may require that we relinquish or license to a third party on unfavorable terms our rights to tests we otherwise would seek to develop or commercialize ourselves, or reserve certain opportunities for future potential arrangements when we might be able to achieve more favorable terms.

If we are not able to secure additional funding when needed, we may have to delay, reduce the scope of or eliminate one or more research and development programs or sales and marketing initiatives. In addition, we may have to work with a partner on one or more aspects of our tests or market development programs, which could lower the economic value of those tests or programs to us. While we believe our existing cash and cash equivalents, and the anticipated proceeds from this offering, will be sufficient to meet our anticipated cash requirements for at least the next 12 months, we cannot assure you that we will generate sufficient revenues from commercial sales to adequately fund our operating needs or achieve or sustain profitability.

We will need to invest in our infrastructure in advance of increased demand for our services, and our failure to accurately forecast demand would have a negative impact on our business and our ability to achieve and sustain profitability.

In order to execute our business model, we need to invest in scaling our infrastructure, including hiring additional personnel, expanding our internal quality assurance program, and expanding laboratory capacity. We will also need to purchase additional equipment, some of which can take several months or more to procure, setup, and validate, and increase our software and computing capacity to meet increased demand. There is no assurance that any of these increases in scale, expansion of personnel, equipment, software, and computing capacities, or process enhancements will be successfully implemented, or that we will have adequate space in our laboratory facility to accommodate such required expansion. We expect that much of this growth will be in advance of increased demand for our services. Our current and projected future expense levels are to a large extent fixed and are largely based on our current investment plans and our estimates of future test volume. As a result, if revenues do not meet our expectations we may not be able to promptly adjust or reduce our spending to levels commensurate with our revenues. If we fail to generate demand commensurate with our infrastructure growth or if we fail to scale our infrastructure sufficiently in advance of demand to successfully meet such demand, our business, prospects, financial condition, and results of operations could be adversely affected.

As we commercialize additional services or products, we may need to incorporate new equipment, implement new technology systems and laboratory processes, or hire new personnel with different qualifications. Failure to manage this growth or transition could result in turnaround time delays, higher costs, declining service and/or product quality, deteriorating customer service, and slower responses to competitive challenges. A failure in any one of these areas could make it difficult for us to meet market expectations for our services, and could damage our reputation and the prospects for our business.

We have substantial customer concentration, with a limited number of customers accounting for a substantial portion of our 2018 revenues and accounts receivable.

Like other genomics profiling companies that sell to the pharmaceutical industry, we have customer concentration. We currently derive a significant portion of our revenues from the U.S. Department of Veterans Affairs (the "VA") Million Veteran Program (the "VA MVP"), which accounted for more than 49% of our revenues in 2018, and 59% of our revenues in the three months ended March 31, 2019. Our top five customers, including the VA MVP, accounted for 82% of our revenues in 2018 and 90% of our revenues for the three months ended March 31, 2019. There are inherent risks whenever a large percentage of revenues are concentrated with a limited number of customers. It is not possible for us to predict the future level of demand for our services that will be generated by these customers. In addition, revenues from our larger customers have historically fluctuated and may continue to fluctuate based on the commencement and completion of clinical trials or other projects, the timing of which may be affected by market conditions or other facts, some of which may be outside of our control. Further, while we have long-term contractual arrangements with certain of our customers, these customers are not required to purchase a minimum number of analyses. If any of these customers suspend or terminate clinical trials, receive less funding, experience declining or delayed sales, or otherwise chose to reduce or eliminate their use of our services, we could be pressured to reduce the prices we charge for our services which would have an adverse effect on our margins and financial position, and which would likely negatively affect our revenues and results of operations. In particular, if the VA MVP terminates our services for convenience, which it is permitted to do, such termination would have a material adverse effect on our revenues, cash position, and results of operations. Further, if our largest customers were to cease using or stop payment for our services, it would have a material adverse effect on our accounts receivable, increasing our credit risk. The failure of these customers to pay their balances, or any customer to pay future outstanding balances, would result in an operating expense and reduce our cash flows.

We currently derive a substantial portion of our revenues from DNA sequencing and data analysis services that we provide to our largest customer, the VA MVP. If the VA MVP's demand for and/or funding for our DNA sequencing and data analysis services is substantially reduced, our business, financial condition, operating results, and cash flows would be materially harmed.

We derive a substantial portion of our current and expected future revenues from sales of our DNA sequencing and data analysis services to the VA MVP. In September 2017, we entered into a one-year contract with three one-year option renewal periods with the VA for the VA MVP, pursuant to which we received orders from the VA MVP in September 2017 and 2018.

The VA MVP's orders for DNA sequencing and data analysis services are subject to the availability of funding, enrollment of veterans in the VA MVP study, and the VA MVP's continued demand for our services. We have no certainty that funding will be made available for our services. If the priorities of the VA, the VA MVP, or the U.S. government change, funding for our services may be limited or not available, and our business, financial condition, and operating results and cash flows would be materially harmed. The success of our business and our future operating results are significantly dependent on the VA MVP's receipt of funding for use of our services and the terms of our sales to the VA MVP, including the price per sample, the number of samples and the timing of the VA MVP's deliveries of samples.

If we cannot maintain our current customer relationships, or fail to acquire new customers, our revenue prospects will be reduced. Many of our customers are biopharmaceutical companies engaged in clinical trials of new drug candidates, which are expensive, can take many years to complete, and their outcome is inherently uncertain.

Our customers other than the VA MVP are primarily biopharmaceutical companies that use our services to support clinical trials. Our future success is substantially dependent on our ability to maintain our customer relationships and to establish new ones. Many factors have the potential to impact our customer relations,

including the type of support our customers and potential customers require and our ability to deliver it, our customers' satisfaction with our services, and other factors that may be beyond our control. Furthermore, our customers may decide to decrease or discontinue their use of our services due to changes in research and product development plans, failures in their clinical trials, financial constraints, or utilization of internal testing resources or tests performed by other parties, or other circumstances outside of our control.

We engage in conversations with customers regarding potential commercial opportunities on an ongoing basis in the event that one of these customers' drug candidates is approved. There is no assurance that any of these conversations will result in a commercial agreement, or if an agreement is reached, that the resulting relationship will be successful or that clinical studies conducted as part of the engagement will produce successful outcomes. Speculation in the industry about our existing or potential relationships with biopharmaceutical companies could be a catalyst for adverse speculation about us, our services, and our technology, which can adversely affect our reputation and our business. In addition, the termination of these relationships could result in a temporary or permanent loss of revenue.

Our customers' clinical trials are expensive, can take many years to complete, and their outcome is inherently uncertain. Failure can occur at any time during the clinical trial process. Product candidates in later stages of clinical trials may fail to show the desired safety and efficacy traits despite having progressed through pre-clinical studies and early clinical trials. Many of the biopharmaceutical companies that are our customers do not have products approved for commercial sale and are not profitable. These customers must continue to raise capital in order to continue their development programs and to potentially continue as our customers. If our customers' clinical trials fail or they are unable to raise sufficient capital to continue investing in their clinical programs, our revenues from these customers may decrease or cease entirely, and our business may be harmed. Furthermore, even if these customers have a drug approved for commercial sale, they may not choose to use our services as a companion diagnostic with their drug, thereby limiting our potential revenues.

The size of the potential future market for our services is an estimate and may be smaller than we believe.

Our estimate of the potential future market for our services is based on a number of internal and third-party estimates. While we believe these factors have historically provided and will continue to provide us with effective tools in estimating the total market for our services, these estimates may not be correct and the conditions supporting our estimates may change at any time, thereby reducing the predictive accuracy of these underlying factors. As a result, our estimates of the total addressable market for our services may prove to be incorrect. If the actual number of patients who would benefit from our services and the total addressable market for our services is smaller than we have estimated, our future growth could be adversely impacted. See the section titled "Market, Industry, and Other Data" for additional information regarding our estimates.

We rely on a limited number of suppliers, or in some cases, a sole supplier, for some of our laboratory instruments and materials, and we may not be able to find replacements or immediately transition to alternative suppliers should we need to do so.

We rely on a limited number of suppliers for sequencers and other equipment and materials that we use in our laboratory operations. For example, we rely on Illumina, Inc. ("Illumina") as the sole supplier of sequencers and various associated reagents, and as the sole provider of maintenance and repair services for these sequencers. Our master subcontractor agreement with Illumina is set to expire in August 2021, and our various pricing agreements with Illumina are set to expire on various dates from June 2019 to December 2022. Any disruption in Illumina's operations, or our inability to negotiate an extension to our agreements with Illumina on acceptable terms, or at all, could impact our supply chain and laboratory operations and our ability to conduct our business and generate revenue. Our suppliers could cease supplying these materials, reagents, and equipment at any time, or fail to provide us with sufficient quantities of materials or materials that meet our specifications. Our laboratory operations could be interrupted if we encounter delays or difficulties in securing equipment, materials, reagents, or sequencers, or if we cannot obtain an acceptable substitute. Any such interruption could significantly affect our business, financial condition, results of operations, and reputation.

We believe that there are only a few manufacturers other than Illumina that are currently capable of supplying and servicing the equipment necessary for our laboratory operations, including sequencers and various associated reagents. The use of equipment or materials provided by these replacement suppliers would require us to alter our laboratory operations. Transitioning to a new supplier would be time-consuming and expensive, may result in interruptions in our laboratory operations, could affect the performance specifications of our laboratory operations, or could require that we revalidate our tests. We cannot assure you that we will be able to secure alternative equipment, reagents, and other materials, and bring such equipment, reagents, and materials on line and revalidate them without experiencing interruptions in our workflow. If we encounter delays or difficulties in securing, reconfiguring, or revalidating the equipment and reagents we require for our services, our business, financial condition, results of operations, and reputation could be adversely affected.

In addition, the Device Master File that we have filed with the FDA, which is focused on the technology, quality management, and validation of our platform, specifically on its use for the development of personalized immuno-therapies, is predicated on our use of specified equipment and processes, including Illumina sequencers and related equipment. The detailed information in the Device Master File is not shared with our customers, but with our permission they can reference our FDA file number in their Investigational New Drug filings with the FDA. If we were required to transition to a new supplier of sequencers or certain other equipment or processes in our laboratory, our Device Master File would need to be replaced or updated, and until such time as that occurred, customers for which we deliver services after the transition would not be able to reference our Device Master File, which would cause us to lose a competitive advantage.

If our sole laboratory facility becomes damaged or inoperable, or we are required to vacate the facility, our ability to sell and provide our services and pursue our research and development efforts may be jeopardized.

We currently derive our revenues from our genomic analysis conducted in our laboratory. We do not have any clinical reference laboratory facilities other than our facility in Menlo Park, California. Our facilities and equipment could be harmed or rendered inoperable by natural or man-made disasters, including fires, earthquakes, flooding, and power outages, which may render it difficult or impossible for us to sell or perform our services for some period of time. Northern California has recently experienced serious fires and the San Francisco Bay Area is considered to lie in an area with earthquake risk. The inability to sell or to perform our diagnostic and other services, or the backlog of samples that could develop if our facility is inoperable for even a short period of time, may result in the loss of customers or harm to our reputation or relationships with scientific or clinical collaborators, and we may be unable to regain those customers or repair our reputation or such relationships in the future. Furthermore, our facilities and the equipment we use to perform our services and our research and development work could be costly and time-consuming to repair or replace.

Additionally, a key component of our research and development process involves using biological samples as the basis for the development of our services. In some cases, these samples are difficult to obtain. If the parts of our laboratory facility where we store these biological samples were damaged or compromised, our ability to pursue our research and development projects, as well as our reputation, could be jeopardized. We carry insurance for damage to our property and the disruption of our business, but this insurance may not be sufficient to cover all of our potential losses and may not continue to be available to us on acceptable terms, if at all.

Further, if our laboratory became inoperable, we would likely not be able to license or transfer our technology to another facility with the necessary qualifications, including state licensure and CLIA certification, under the scope of which our current and our planned future services could be performed. Even if we find a facility with such qualifications to perform our services, it may not be available to us on commercially reasonable terms.

Our internal information technology systems, or those of our third-party vendors, contractors, or consultants, may fail or suffer security breaches, loss or leakage of data, and other disruptions, which could result in a material disruption of our services, compromise sensitive information related to our business, or prevent us from accessing critical information, potentially exposing us to liability or otherwise adversely affecting our business.

We are increasingly dependent upon information technology systems, infrastructure, and data to operate our business. In the ordinary course of business, we collect, store, and transmit confidential information (including but not limited to intellectual property, proprietary business information, and personal information). It is critical that we do so in a secure manner to maintain the confidentiality and integrity of such confidential information. We also have outsourced elements of our operations to third parties, and as a result we manage a number of third-party vendors and other contractors and consultants who have access to our confidential information.

Despite the implementation of security measures, given the size and complexity of our internal information technology systems and those of our third-party vendors and other contractors and consultants, and the increasing amounts of confidential information that they maintain, our such information technology systems are potentially vulnerable to breakdown or other damage or interruption from service interruptions, system malfunction, natural disasters, terrorism, war, and telecommunication and electrical failures, as well as security breaches from inadvertent or intentional actions by our employees, third-party vendors, contractors, consultants, business partners, and/or other third parties, or from cyber-attacks by malicious third parties (including the deployment of harmful malware, ransomware, denial-of-service attacks, social engineering, and other means to affect service reliability and threaten the confidentiality, integrity, and availability of information), which may compromise our system infrastructure, or that of our third-party vendors and other contractors and consultants, or lead to data leakage. The risk of a security breach or disruption, particularly through cyber-attacks or cyber intrusion, including by computer hackers, foreign governments, and cyber terrorists, has generally increased as the number, intensity, and sophistication of attempted attacks and intrusions from around the world have increased. We may not be able to anticipate all types of security threats, and we may not be able to implement preventive measures effective against all such security threats. The techniques used by cyber criminals change frequently, may not be recognized until launched, and can originate from a wide variety of sources, including outside groups such as external service providers, organized crime affiliates, terrorist organizations, or hostile foreign governments or agencies. To the extent that any disruption or security breach were to result in a loss of, or damage to, our data or applications, or those of our third-party vendors and other contractors and consultants, or inappropriate disclosure of confidential or proprietary information, we could incur liability and reputational damage and the further development and commercialization of our services could be delayed. The costs related to significant security breaches or disruptions could be material and exceed the limits of the cybersecurity insurance we maintain against such risks. If the information technology systems of our third-party vendors and other contractors and consultants become subject to disruptions or security breaches, we may have insufficient recourse against such third parties and we may have to expend significant resources to mitigate the impact of such an event, and to develop and implement protections to prevent future events of this nature from occurring.

While we have not experienced any such system failure, accident, or security breach to date, and believe that our data protection efforts and our investment in information technology reduce the likelihood of such incidents in the future, we cannot assure you that our data protection efforts and our investment in information technology will prevent significant breakdowns, data leakages, breaches in our systems, or those of our third-party vendors and other contractors and consultants, or other cyber incidents that could have a material adverse effect upon our reputation, business, operations, or financial condition. For example, if such an event were to occur and cause interruptions in our operations, or those of our third-party vendors and other contractors and consultants, it could result in a material disruption of our programs and the development of our services and technologies could be delayed. Furthermore, significant disruptions of our internal information technology systems or those of our third-party vendors and other contractors and consultants, or security breaches could result in the loss, misappropriation, and/or unauthorized access, use, or disclosure of, or the prevention of access to, confidential information (including trade secrets or other intellectual property, proprietary business

information, and personal information), which could result in financial, legal, business, and reputational harm to us. For example, any such event that leads to unauthorized access, use, or disclosure of personal information, including personal information regarding our customers or employees, could harm our reputation directly, compel us to comply with federal and/or state breach notification laws and foreign law equivalents, subject us to mandatory corrective action, and otherwise subject us to liability under laws and regulations that protect the privacy and security of personal information, which could result in significant legal and financial exposure and reputational damages that could potentially have an adverse effect on our business.

Security breaches, loss of data, and other disruptions could compromise sensitive information related to our business or prevent us from accessing critical information and expose us to liability, which could adversely affect our business and our reputation.

In the ordinary course of our business, we collect and store sensitive data, including protected health information ("PHI"), personally identifiable information ("PII"), credit card and other financial information, intellectual property, and proprietary business information owned or controlled by ourselves or our customers, payors, and other parties. We manage and maintain our applications and data utilizing a combination of on-site systems and cloud-based data centers. We utilize external security and infrastructure vendors to manage parts of our data centers. We also communicate sensitive data, including patient data, electronically, and through relationships with multiple third-party vendors and their subcontractors. These applications and data encompass a wide variety of business-critical information, including research and development information, patient data, commercial information, and business and financial information. We face a number of risks relative to protecting this critical information, including loss of access risk, inappropriate use or disclosure, inappropriate modification, and the risk of our being unable to adequately monitor, audit, and modify our controls over our critical information. This risk extends to the third-party vendors and subcontractors we use to manage this sensitive data.

The secure processing, storage, maintenance, and transmission of this critical information are vital to our operations and business strategy, and we devote significant resources to protecting such information. 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, liability under federal or state laws that protect the privacy of personal information, such as the Health Insurance Portability and Accountability Act of 1996 ("HIPAA") and 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 ("HHS"), 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. Although we have implemented security measures and a formal, dedicated enterprise security program to prevent unauthorized access to patient data, such data is currently accessible through multiple channels, and there is no guarantee we can protect our data from breach. Unauthorized access, loss, or dissemination could also damage our reputation or disrupt our operations, including our ability to conduct our analyses, deliver test results, process claims and appeals, provide customer assistance, conduct research and development activities, collect, process, and prepare company financial information, provide information about our tests and other patient and physician education and outreach efforts through our website, and manage the administrative aspects of our business.

Penalties for violations of these laws vary. For instance, penalties for failure to comply with a requirement of HIPAA and HITECH vary significantly, and include significant civil monetary penalties and, in certain circumstances, criminal penalties with fines up to $250,000 per violation and/or imprisonment. In addition, numerous breach incidents could lead to possible penalties in excess of $1.68 million. A person who knowingly obtains or discloses individually identifiable health information in violation of HIPAA may face a criminal penalty of up to $50,000 and up to one-year imprisonment. The criminal penalties increase if the wrongful

conduct involves false pretenses or the intent to sell, transfer or use identifiable health information for commercial advantage, personal gain or malicious harm.

Further, various states, such as California and Massachusetts, have implemented similar privacy laws and regulations, such as the California Confidentiality of Medical Information Act, that impose restrictive requirements regulating the use and disclosure of health information and other personally identifiable information. These laws and regulations are not necessarily preempted by HIPAA, particularly if a state affords greater protection to individuals than HIPAA. Where state laws are more protective, we have to comply with the stricter provisions. In addition to fines and penalties imposed upon violators, some of these state laws also afford private rights of action to individuals who believe their personal information has been misused. California's patient privacy laws, for example, provide for penalties of up to $250,000 and permit injured parties to sue for damages. The interplay of federal and state laws may be subject to varying interpretations by courts and government agencies, creating complex compliance issues for us and data we receive, use and share, potentially exposing us to additional expense, adverse publicity and liability. Further, as regulatory focus on privacy issues continues to increase and laws and regulations concerning the protection of personal information expand and become more complex, these potential risks to our business could intensify. Changes in laws or regulations associated with the enhanced protection of certain types of sensitive data, such as PHI or PII, for the treatment of genetic data, along with increased customer demands for enhanced data security infrastructure, could greatly increase our cost of providing our services, decrease demand for our services, reduce our revenues and/or subject us to additional liabilities.

In addition, the interpretation and application of consumer, health-related and data protection laws, especially with respect to genetic samples and data, in the United States, the European Union (the "EU"), and elsewhere are often uncertain, contradictory and in flux. For example, the EU-wide General Data Protection Regulation (EU) 2016/679 ("GDPR") became applicable on May 25, 2018, replacing data protection laws issued by of each EU member state based on the Directive 95/46/EC (the "Directive"). Unlike the Directive, which needed to be transposed at a national level, the GDPR text is directly applicable in each EU member state, resulting in a more uniform application of data privacy laws across the EU. The GDPR imposes onerous accountability obligations requiring data controllers and processors to maintain a record of their data processing and policies. It requires data controllers to implement more stringent operational requirements for processors and controllers of personal data, including, for example, transparent and expanded disclosure to data subjects (in a concise, intelligible and easily accessible form) about how their personal information is to be used, imposes limitations on retention of information, increases requirements pertaining to health data and pseudonymized (i.e., key-coded) data, introduces mandatory data breach notification requirements and sets higher standards for data controllers to demonstrate that they have obtained valid consent for certain data processing activities. Fines for non-compliance with the GDPR will be significant—the greater of €20 million or 4% of global turnover. The GDPR provides that EU member states may introduce further conditions, including limitations, to make their own further laws and regulations limiting the processing of genetic, biometric or health data, which could limit our ability to collect, use and share European data, or could cause our compliance costs to increase, ultimately having an adverse impact on our business, and harm our business and financial condition. It is possible that these laws may be interpreted and applied in a manner that is inconsistent with our practices. If so, this could result in government-imposed fines or orders requiring that we change our practices, which could adversely affect our business. Further, the United Kingdom's vote in favor of exiting the EU, often referred to as Brexit, has created uncertainty with regard to data protection regulation in the United Kingdom. In particular, it is unclear whether the United Kingdom will enact data protection legislation equivalent to the GDPR and how data transfers to and from the United Kingdom will be regulated.

Compliance with U.S. and international data protection laws and regulations could cause us to incur substantial costs or require us to change our business practices and compliance procedures in a manner adverse to our business. Moreover, complying with these various laws could require us to take on more onerous obligations in our contracts, restrict our ability to collect, use and disclose data, or in some cases, impact our ability to operate in certain jurisdictions. We rely on our customers to obtain valid and appropriate consents from data

subjects whose genetic samples and data we process on such customers' behalf. Given that we do not obtain direct consent from such data subjects and we do not audit our customers to ensure that they have obtained the necessary consents required by law, the failure of our customers to obtain consents that are in compliance with applicable law could result in our own non-compliance with privacy laws. Such failure to comply with U.S. and international data protection laws and regulations could result in government enforcement actions (which could include civil or criminal penalties), private litigation and/or adverse publicity and could negatively affect our operating results and business. Claims that we have violated individuals' privacy rights, failed to comply with data protection laws, or breached our contractual obligations, even if we are not found liable, could be expensive and time consuming to defend, could result in adverse publicity and could have a material adverse effect on our business, financial condition and results of operations.

Our success depends on our ability to provide reliable, high-quality genomic data and analyses and to rapidly evolve to meet our customers' needs.

Errors, including if our tests fail to accurately detect gene variants, or mistakes, including if we fail to or incompletely or incorrectly identify the significance of gene variants, could have a significant adverse impact on our business. We classify variants in accordance with guidelines that are subject to change and subject to our interpretation. There can also be flaws in the databases, third-party tools, algorithms we use, and in the software that handle automated parts of our classification protocol. If we receive poor quality or degraded samples, our tests may be unable to accurately detect gene variants or we may fail to or incompletely or incorrectly identify the significance of gene variants, which could have a significant adverse impact on our business.

Inaccurate results or misunderstandings of, or inappropriate reliance on, the information we provide to our customers could lead to, or be associated with, side effects or adverse events in patients who use our tests, including treatment-related death, and could lead to termination of our services or claims against us. A product liability or professional liability claim could result in substantial damages and be costly and time-consuming for us to defend.

Although we maintain liability insurance, including for errors and omissions, and professional liability, we cannot assure you that our insurance would be sufficient to protect us from the financial impact of defending against these types of claims, or any judgments, fines or settlement costs arising out of any such claims. Any liability claim, including an errors and omissions liability claim, brought against us, with or without merit, could increase our insurance rates or prevent us from securing insurance coverage in the future. Additionally, any liability lawsuit could cause injury to our reputation or cause us to suspend sales of our tests or cause a suspension of our license to operate. The occurrence of any of these events could have an adverse effect on our business, reputation and results of operations.

If we cannot develop services and products to keep pace with rapid advances in technology, medicine and science, or experience delays in developing such services and products, our operating results and competitive position could be harmed.

In recent years, there have been numerous advances in technologies relating to the diagnosis and treatment of cancer. Several new cancer drugs have been approved, and a number of new drugs are in pre-clinical and clinical development. There have also been advances in methods used to identify patients likely to benefit from these drugs based on analysis of biomarkers. We must continuously develop new services and products, enhance any existing services, and avoid delays in such developments and enhancements to keep pace with evolving technologies on a timely and cost-effective basis. Our current services and our planned future services and products (such as our planned liquid biopsy test) could become obsolete unless we continually innovate and expand them to demonstrate benefit in the diagnosis, monitoring, or prognosis of patients with cancer. New cancer therapies typically have only a few years of clinical data associated with them, and much of that data may not be disclosed by the pharmaceutical company that conducted the clinical trials. This could limit our ability to develop services and products based on, for example, biomarker analysis related to the appearance or

development of resistance to those therapies. If we cannot adequately demonstrate the clinical utility of our services and our planned future services and products to new treatments, sales of our services could decline, which would have a material adverse effect on our business, financial condition, and results of operations.

We are researching and developing improvements to our tests and test features on a continuous basis, but we may not be able to make these improvements on a timely basis, and even if we do, we may not realize the benefits of these efforts in our financial results.

To remain competitive, we must continually research and develop improvements to our tests or test features. However, we cannot assure you that we will be able to develop and commercialize the improvements to our tests or test features on a timely basis. Our competitors may develop and commercialize competing or alternative tests and improvements faster than we are able to do so. In addition, we must expend significant time and funds in order to conduct research and development, further develop and scale our laboratory processes, and further develop and scale our infrastructure. We may never realize a return on investment on this effort and expense, especially if our improvements fail to perform as expected. If we are not able to realize the benefits of our efforts to improve our tests or test features, it could have an adverse effect on our business, financial condition, and results of operations.

Personalized cancer therapies represent new therapeutic approaches that could result in heightened regulatory scrutiny, delays in clinical development, or delays in or inability to achieve regulatory approval, commercialization, or payor coverage, any of which could adversely affect our business.

We currently work with certain companies developing personalized cancer therapies, and our future success will in part depend on our personalized cancer customers obtaining regulatory approval for and commercializing their product candidate. Because personalized cancer therapies represent a new approach to immunotherapy for the treatment of cancer and other diseases, developing and commercializing personalized cancer therapies is subject to a number of challenges.

Actual or perceived safety issues, including adoption of new therapeutics or novel approaches to treatment, may adversely influence the willingness of subjects to participate in clinical studies, or if approved by applicable regulatory authorities, of physicians to subscribe to the novel treatment mechanics. The FDA or other applicable regulatory authorities may ask for specific post-market requirements, and additional information regarding benefits or risks of our services may emerge at any time prior to or after regulatory approval.

Physicians, hospitals, and third-party payors often are slow to adopt new products, technologies, and treatment practices that require additional upfront costs and training. Physicians may not be willing to undergo training to adopt personalized cancer therapies, may decide that such therapies are too complex to adopt without appropriate training or not cost-efficient, and may choose not to administer these therapies. Based on these and other factors, hospitals and payors may decide that the benefits of personalized cancer therapies do not or will not outweigh their costs.

The loss of key members of our executive management team could adversely affect our business.

Our success in implementing our business strategy depends largely on the skills, experience, and performance of key members of our executive management team and others in key management positions, including John West, our Chief Executive Officer, Richard Chen, our Chief Scientific Officer, Clinton Musil, our Chief Business Officer, and Aaron Tachibana, our Chief Financial Officer. The collective efforts of each of these persons and others working with them as a team are critical to us as we continue to develop our technologies, services, products, and research and development programs. As a result of the difficulty in locating qualified new management, the loss or incapacity of existing members of our executive management team could adversely affect our operations. If we were to lose one or more of these key employees, we could experience difficulties in finding qualified successors, competing effectively, developing our technologies, and implementing our business

strategy. Each member of our executive management team has an employment agreement; however, the existence of an employment agreement does not guarantee retention of members of our executive management team and we may not be able to retain those individuals. We do not maintain "key person" life insurance on any of our employees.

In addition, we rely on collaborators, consultants, and advisors, including scientific and clinical advisors, to assist us in formulating our research and development and commercialization strategy. Our collaborators, consultants, and advisors are generally employed by employers other than us and may have commitments under agreements with other entities that may limit their availability to us.

The loss of a key employee, the failure of a key employee to perform in his or her current position, or our inability to attract and retain skilled employees could result in our inability to continue to grow our business or to implement our business strategy.

We rely on highly skilled personnel in a broad array of disciplines and if we are unable to hire, retain, or motivate these individuals, or maintain our corporate culture, we may not be able to maintain the quality of our services or grow effectively.

Our performance, including our research and development programs and laboratory operations, largely depends on our continuing ability to identify, hire, develop, motivate, and retain highly skilled personnel for all areas of our organization. Competition in our industry for qualified employees is intense, and we may not be able to attract or retain qualified personnel in the future, including bioinformatic scientists, bioinformatic engineers, software engineers, statisticians, variant curators, clinical laboratory scientists, and genetic counselors, due to the competition for qualified personnel among life science businesses, technology companies, as well as universities and public and private research institutions, particularly in the San Francisco Bay Area. All of our U.S. employees are at-will, which means that either we or the employee may terminate their employment at any time. In addition, our compensation arrangements, such as our equity award programs, may not always be successful in attracting new employees and retaining and motivating our existing employees, including due to movements in our stock price. If we are not able to attract and retain the necessary personnel to accomplish our business objectives, we may experience constraints that could adversely affect our ability to scale our business and support our research and development efforts and our laboratory operations. We believe that our corporate culture fosters innovation, creativity, and teamwork. However, as our organization grows, we may find it increasingly difficult to maintain the beneficial aspects of our corporate culture. This could negatively impact our ability to retain and attract employees and our future success.

We may not be able to manage our future growth effectively, which could make it difficult to execute our business strategy.

Our expected future growth could create a strain on our organizational, administrative, and operational infrastructure, including laboratory operations, quality control, customer service, marketing and sales, and management. We may not be able to maintain the quality of or expected turnaround times for our tests, or satisfy customer demand as our test volume grows. Our ability to manage our growth properly will require us to continue to improve our operational, financial, and management controls, as well as our reporting systems and procedures. As a result of our growth, our operating costs may escalate even faster than planned, and some of our internal systems may need to be enhanced or replaced. If we are unable to manage our growth effectively, it may be difficult for us to execute our business strategy and our business could be harmed.

We depend on our information technology systems, and any failure of these systems could harm our business.

We depend on information technology and telecommunications systems for significant elements of our operations, including our laboratory information management system, our bioinformatics analytical software

systems, our database of information relating to genetic variations and their role in disease process, our clinical report systems, our billing systems, our business intelligence systems, our logistics and customer relationship systems, our customer-facing web-based software, our customer reporting, and our family history and risk assessment tools. We have installed, and expect to expand, a number of enterprise software systems that affect a broad range of business processes and functional areas, including, for example, systems handling human resources, financial reporting and controls, customer relationship management, regulatory compliance, and other infrastructure operations.

Although we invest substantially in the backup/restore, high-availability architecture, monitoring and reporting, documentation and preventive security controls of our systems, all information technology and telecommunications systems are vulnerable to damage from a variety of sources, including telecommunications or network failures, malicious or inadvertent human acts and natural disasters. Our servers are potentially vulnerable to physical or electronic break-ins, employee errors, computer viruses and similar disruptive problems. Despite the precautionary measures we have taken to prevent unanticipated problems that could affect our information technology and telecommunications systems, failures or significant downtime of our information technology or telecommunications systems or those used by our third-party service providers could prevent us from conducting tests, preparing and providing reports to our customers, billing customers, collecting revenue, handling inquiries from our customers, conducting research and development activities, and managing the administrative aspects of our business. For example, in the first quarter of 2018, we experienced downtime in our information technology systems in connection with the adoption of certain new information technology, and experienced an adverse effect to our results of operations in the first and second quarters of 2018 were adversely affected as a result. Any disruption or loss of information technology or telecommunications systems on which critical aspects of our operations depend could have an adverse effect on our business.

Additionally, we have internally developed, and expect to continue to invest in and expand, proprietary informatics and software systems that are designed to manage the unique aspects and challenges of our genomics laboratory and on which we depend. Any disruption of failure of our internally developed informatics and software systems could have an adverse effect on our business.

Our employees may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements, which could cause significant liability for us and harm our reputation.

We are exposed to the risk of employee fraud or other misconduct, including intentional failures to comply with government regulations, including federal and state healthcare fraud and abuse laws and regulations, to misuse information, including patient information, and to report financial information or data accurately or disclose unauthorized activities to us. Such misconduct could also involve the improper use of information obtained in the course of clinical studies, which could result in regulatory sanctions and cause serious harm to our reputation. We have a code of conduct and ethics for our directors, officers and employees, but it is not always possible to identify and deter employee misconduct, and the precautions we take to detect and prevent this activity may not be effective in controlling risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to be in compliance with such laws or regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business and results of operations, including the imposition of significant administrative, civil and criminal penalties, damages, fines, imprisonment, exclusion from government healthcare programs, contractual damages, refunding of payments received by us, reputational harm, additional reporting, or oversight obligations if we become subject to a corporate integrity agreement or other agreement to resolve allegations of non-compliance with the law and curtailment or restructuring of our operations. Whether or not we are successful in defending against such actions or investigations, we could incur substantial costs, including legal fees, and divert the attention of management in defending ourselves against any of these claims or investigations.

We may acquire businesses or assets, form joint ventures, or make investments in other companies or technologies that could harm our operating results, dilute our stockholders' ownership, or cause us to incur debt or significant expense.

As part of our business strategy, we may pursue acquisitions of complementary businesses or assets, as well as technology licensing arrangements. We may also pursue strategic alliances that leverage our core technology and industry experience to expand our offerings or distribution, or make investments in other companies. As an organization, we have limited experience with respect to acquisitions as well as the formation of strategic alliances and joint ventures. We may not identify or complete these transactions in a timely manner, on a cost-effective basis, or at all, and we may not realize the anticipated benefits of any acquisition, technology license, strategic alliance, joint venture or investment. In addition, we may not be able to find suitable partners or acquisition candidates, and we may not be able to complete such transactions on favorable terms, if at all. Any future acquisitions by us also could result in significant write-offs or the incurrence of debt and contingent liabilities, any of which could harm our operating results. If we make any acquisitions in the future, we may not be able to integrate these acquisitions successfully into our existing business, and we could assume unknown or contingent liabilities. Integration of an acquired company or business also may require management resources that otherwise would be available for ongoing development of our existing business.

To finance any acquisitions or investments, we may choose to raise additional funds. The various ways we could raise additional funds carry potential risks. See "—Our inability to raise additional capital on acceptable terms in the future may limit our ability to continue to operate our business and further expand our operations." Once we become a public company, if the price of our common stock is low or volatile, we may not be able to acquire other companies using stock as consideration. Alternatively, it may be necessary for us to raise additional funds for these activities through public or private financings. Additional funds may not be available on terms that are favorable to us, or at all.

We rely on commercial courier delivery services to transport specimens to our laboratory facility in a timely and cost-efficient manner, and if these delivery services are disrupted, our business would be harmed.

Our business depends on our ability to quickly and reliably deliver test results to our customers. Disruptions in delivery service, whether due to labor disruptions, bad weather, natural disaster, terrorist acts, or threats or for other reasons could adversely affect specimen integrity and our ability to process specimens in a timely manner and service our customers, and ultimately our reputation and our business. In addition, if we are unable to continue to obtain expedited delivery services on commercially reasonable terms, our operating results may be adversely affected.

Ethical, legal, and social concerns related to the use of genetic information could reduce demand for our tests.

Genetic testing has raised ethical, legal, and social concerns regarding privacy and the appropriate uses of the resulting information. Governmental authorities have, through the Genetic Information Nondisclosure Act, and could further, for social or other purposes, limit or regulate the use of genetic information or genetic testing or prohibit testing for genetic predisposition to certain conditions, particularly for those that have no known cure. Ethical and social concerns may also influence governmental authorities to deny or delay the issuance of patents for technology relevant to our business. Similarly, these concerns may lead patients to refuse to use, or clinicians to be reluctant to order, genetic tests even if permissible. These and other ethical, legal, and social concerns may limit market acceptance of our tests or reduce the potential markets for our tests, either of which could have an adverse effect on our business, financial condition, or results of operations.

The December 2017 tax reform law could adversely affect our business and financial condition.

On December 22, 2017, President Trump signed into law comprehensive tax legislation (the "Tax Cuts and Jobs Act") that significantly revised the Internal Revenue Code of 1986, as amended (the "Code"). The Tax Cuts

and Jobs Act, among other things, contained significant changes to corporate taxation, including reduction of the corporate tax rate from a top marginal rate of 35% to a flat rate of 21%, limitation of the tax deduction for interest expense to 30% of adjusted taxable income (except for certain small businesses), limitation of the deduction for net operating losses incurred after 2017 to 80% of current year taxable income and elimination of net operating loss carrybacks, one-time taxation of offshore earnings at reduced rates regardless of whether they are repatriated, elimination of U.S. tax on foreign earnings (subject to certain important exceptions), immediate deductions for certain new investments instead of deductions for depreciation expense over time, and modifying or repealing many business deductions and credits. Notwithstanding the reduction in the corporate income tax rate, the overall impact of the Tax Cuts and Jobs Act is uncertain and our business and financial condition could be adversely affected. In addition, it is uncertain if and to what extent various states will conform to the Tax Cuts and Jobs Act. The impact of this tax reform on holders of our common stock is also uncertain and could be adverse. We urge our stockholders to consult with their legal and tax advisors with respect to this legislation and the potential tax consequences of investing in or holding our common stock.

Our effective tax rate may fluctuate, and we may incur obligations in tax jurisdictions in excess of accrued amounts.

We are subject to taxation in numerous U.S. states and territories. As a result, our effective tax rate is derived from a combination of applicable tax rates in the various places that we operate. In preparing our financial statements, we estimate the amount of tax that will become payable in each of such places. Nevertheless, our effective tax rate may be different than experienced in the past due to numerous factors, including passage of the Tax Cuts and Jobs Act, changes in the mix of our profitability from state to state, the results of examinations and audits of our tax filings, our inability to secure or sustain acceptable agreements with tax authorities, changes in accounting for income taxes and changes in tax laws. Any of these factors could cause us to experience an effective tax rate significantly different from previous periods or our current expectations and may result in tax obligations in excess of amounts accrued in our financial statements.

Risks Related to Government Regulation

Our tests may be subject to regulatory action if regulatory agencies determine that our tests do not appropriately comply with statutory and regulatory requirements enforced by the U.S. Food and Drug Administration, and/or CLIA requirements for quality laboratory testing.

The laws and regulations governing the marketing of clinical laboratory tests are extremely complex and in many instances there are no significant regulatory or judicial interpretations of these laws and regulations. The Federal Food, Drug and Cosmetic Act (the “FDC Act”) defines a medical device to include any instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent or other similar or related article, including a component, part, or accessory, 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. Some of our tests may be considered by the FDA to be in vitro diagnostic products that are subject to regulation as medical devices. Among other things, pursuant to the FDC Act and its implementing regulations, the FDA regulates the research, testing, manufacturing, safety, labeling, storage, recordkeeping, premarket clearance or approval, marketing and promotion, and sales and distribution of medical devices in the United States to ensure that medical products distributed domestically are safe and effective for their intended uses. In addition, the FDA regulates the import and export of medical devices.

Although the FDA has statutory authority to assure that medical devices are safe and effective for their intended uses, the FDA has generally exercised its enforcement discretion and not enforced applicable regulations with respect to laboratory developed tests (“LDTs”), which are a subset of in vitro diagnostic devices that are intended for clinical use and designed, manufactured and used entirely within a single laboratory. We currently market our tests as LDTs and, therefore, we believe that they are not currently subject to the FDA’s enforcement of its medical device regulations and the applicable FDC Act provisions. Despite the FDA’s historic

enforcement discretion policy with respect to LDTs, in November 2017, the FDA finalized a classification order setting out the regulatory requirements that apply to certain genetic health risk tests and revised a separate classification order exempting certain carrier screening tests from FDA premarket clearance and approval requirements when certain regulatory requirements are met. None of our tests comply with these classification orders because we market our tests as LDTs that are subject to the FDA's policy of enforcement discretion. However, the FDA may find that our tests do not fall within the definition of an LDT, and may determine that our tests are subject to the FDA's enforcement of its medical device regulations, including the recent classification orders, and the applicable FDC Act provisions. While we believe that we are currently in material compliance with applicable laws and regulations, we cannot assure you that the FDA or other regulatory agencies would agree with our determination, and a determination that we have violated these laws, or a public announcement that we are being investigated for possible violations of these laws, could adversely affect our business, prospects, results of operations or financial condition. If the FDA determines that our tests are subject to enforcement as medical devices, we could be subject to enforcement action, including administrative and judicial sanctions, and additional regulatory controls and submissions for our tests, all of which could be burdensome. See "—Failure to comply with federal, state, and foreign laboratory licensing requirements and the applicable requirements of the FDA or any other regulatory authority, could cause us to lose the ability to perform our tests, experience disruptions to our business or become subject to administrative or judicial sanctions."

Moreover, LDTs may in the future become subject to more onerous regulation by the FDA. A significant change in any of the laws, regulations or policies may require us to change our business model in order to maintain regulatory compliance. At various times since 2006, the FDA has issued documents outlining its intent to require varying levels of FDA oversight of many types of LDTs. In October 2014, the FDA issued two non-binding draft guidance documents that set forth a proposed risk-based regulatory framework that would apply varying levels of FDA oversight to LDTs. The FDA indicated that it did not intend to implement its proposed framework until the draft guidance documents are finalized. The FDA was expected to finalize its proposal for the oversight of LDTs before the end of 2016, but in November 2016, the FDA announced that it would halt finalizing of the guidance documents and continue to work with stakeholders, the incoming administration and Congress on the approach to LDT regulation. This announcement was followed by the issuance of an information discussion paper on January 13, 2017, in which the FDA outlined a substantially revised "possible approach" to the oversight of LDTs. The discussion paper explicitly states that it is not a final version of the 2014 draft guidance and that it is not enforceable and does not represent the FDA's "formal position." It is unclear at this time if or when the FDA will finalize its plans to end enforcement discretion for LDTs, and even then, whether the new regulatory requirements are expected to be phased-in over time. However, the FDA may decide to regulate certain LDTs on a case-by-case basis at any time, which could result in delay or additional expense in offering our tests and tests that we may develop in the future.

Legislative proposals addressing oversight of genetic testing and LDTs have been introduced in previous Congresses, and we expect that new legislative proposals will be introduced from time to time in the future. We cannot provide any assurance that FDA regulation, including pre-market review, will not be required in the future for our tests, whether through finalization of guidance issued by the FDA, new enforcement policies adopted by the FDA or new legislation enacted by Congress. It is possible that legislation will be enacted into law or guidance could be issued by the FDA which may result in increased regulatory burdens for us to continue to offer our tests or to develop and introduce new tests. This legislative and regulatory uncertainty exposes us to the possibility of enforcement action or additional regulatory controls and submissions for our tests, both of which could be burdensome. We cannot be certain that the FDA will not enact rules or guidance documents which could impact our ability to purchase certain materials necessary for the performance of our tests, such as products labeled for research use only. Should any of the reagents obtained by us from suppliers and used in conducting our tests be affected by future regulatory actions, our business could be adversely affected by those actions, including increasing the cost of testing or delaying, limiting or prohibiting the purchase of reagents necessary to perform testing.

Additionally, the Centers for Medicare & Medicaid Services ("CMS"), and certain state agencies regulate the performance of LDTs (as authorized under CLIA and state law, respectively). Our tests are developed in compliance with CLIA requirements. However, if our laboratory fails to comply with the prescribed quality requirements for laboratory testing or other requirements for CLIA, we could lose CLIA certification. That in turn would impact our ability to operate our laboratory and provide results to our customers, which could negatively impact our business operations.

If the FDA determines that our services are subject to enforcement as medical devices, we could incur substantial costs and time delays associated with satisfying statutory and regulatory requirements such as pre-market clearance or approval and we could incur additional expense in offering our tests and tests that we may develop in the future.

If the FDA determines that our tests and associated software do not fall within the definition of an LDT, or there are regulatory or legislative changes, we may be required to obtain premarket clearance for our tests and associated software under Section 510(k) of the FDC Act or approval of a premarket approval application ("PMA"). We would also be subject to ongoing regulatory requirements such as registration and listing requirements, medical device reporting requirements, and quality control requirements. If our tests are considered medical devices not subject to enforcement discretion, the regulatory requirements to which our tests are subject would depend on the FDA's classification of our tests. The FDA has issued regulations classifying over 1,700 different generic types of medical devices into one of three regulatory control categories (Class I, Class II, or Class III) depending on the degree of regulation that the FDA finds necessary to provide reasonable assurance of their safety and effectiveness. The class into which a device is placed determines the requirements that a medical device manufacturer must meet both pre- and post-market.

Generally, Class I devices do not require premarket authorization, but are subject to a comprehensive set of regulatory authorities referred to as general controls. Class II devices, in addition to general controls, generally require special controls and premarket clearance through the submission of a section 510(k) premarket notification. Class III devices are subject to general controls and special controls, and also require premarket approval prior to commercial distribution, which is a more rigorous process than premarket clearance. Under the FDC Act, a device that is first marketed after May 28, 1976 is by default a Class III device requiring premarket approval unless it is within a type of generic device class that has been classified as Class I or Class II. Even if a device falls under an existing Class II, non-exempt, device classification, the product must also be shown to be "substantially equivalent" to a legally marketed predicate device through submission of a section 510(k) premarket notification. If after reviewing a firm's 510(k) premarket notification, the FDA determines that a device is not substantially equivalent to a legally marketed predicate device, the new device is classified into Class III, requiring premarket approval. It is possible for a manufacturer to obtain a Class I or Class II designation without an appropriate predicate by submitting a *de novo* request for reclassification.

The process for submitting a 510(k) premarket notification and receiving FDA clearance usually takes from three to twelve months, but it can take significantly longer and clearance is never guaranteed. The process for submitting and obtaining FDA approval of a PMA is much more costly, lengthy, and uncertain. It generally takes from one to three years or even longer and approval is not guaranteed. PMA approval typically requires extensive clinical data and can be significantly longer, more expensive and more uncertain than the 510(k) clearance process. Despite the time, effort and expense expended, there can be no assurance that a particular device ultimately will be cleared or approved by the FDA through either the 510(k) clearance process or the PMA process on a timely basis, or at all.

If our tests are considered medical devices not subject to enforcement discretion, one classification regulation that could be relevant to one or more of our tests is a recently finalized classification for genetic health risk ("GHR"), assessment tests. On April 6, 2017, in response to a *de novo* request for reclassification submitted by another company, the FDA issued an order classifying genetic tests known as genetic health risk assessment systems ("GHR tests") as Class II devices subject to premarket notification and specified special controls

requirements. On November 7, 2017, the FDA codified this classification at 21 C.F.R. § 866.5950. If our tests are considered medical devices that are not subject to enforcement discretion and one or more of our tests is considered to fall under the 21 C.F.R. § 866.5950 classification regulation for GHR tests, or under another Class II classification that is subject to a premarket notification requirement, we would be required to obtain marketing clearance for such tests. Further, if considered to fall under the 21 C.F.R. § 866.5950 classification for GHR tests, our tests would be required to adhere to specified special controls, such as labeling and testing specifications and information about the test to be posted on the manufacturer's website. Although the FDA has also issued a proposal for a simplified path to market GHR tests that would amend the classification regulation at 21 C.F.R. § 886.5950 such that manufacturers would only be subject to a one-time marketing review to ensure that they meet the applicable FDA requirements prior to selling GHR tests in the market, the FDA has yet to finalize this proposal, and we do not know if and when finalization will occur. Even if the FDA finalizes the proposed limited exemption for GHR tests, if any of our current or pipeline tests are not considered by the FDA to be GHR tests or do not qualify for the limited exemption (if and when finalized), or if any of our tests fall under a different non-exempt classification or are unclassified, we could be required to obtain 510(k) clearance or approval of a PMA for such test in the future.

If premarket review of our tests is required, the premarket review process may involve, among other things, successfully completing additional clinical trials. If we are required to conduct premarket clinical trials, whether using prospectively acquired samples or archival samples, delays in the commencement or completion of clinical testing could significantly increase our product development costs, delay commercialization of any future products, and interrupt sales of our current products. Many of the factors that may cause or lead to a delay in the commencement or completion of clinical trials may also ultimately lead to delay or denial of regulatory clearance or approval. The commencement of clinical trials may be delayed due to insufficient patient enrollment, which is a function of many factors, including the size of the patient population, the concerns around genetic testing, the nature of the protocol, the proximity of patients to clinical sites and the eligibility criteria for the clinical trial.

If we are required to conduct clinical trials, we and any third-party contractors we engage would be required to comply with good clinical practices ("GCPs"), which are regulations and guidelines enforced by the FDA, for products in clinical development. The FDA enforces these GCPs through periodic inspections of trial sponsors, principal investigators and trial sites. If we or any third-party contractor fails to comply with applicable GCPs, the clinical data generated in clinical trials may be deemed unreliable and the FDA may require us to perform additional clinical trials before clearing or approving our marketing applications. A failure to comply with these regulations may require us to repeat clinical trials, which would delay the regulatory clearance or approval process. In addition, if these parties do not successfully carry out their contractual duties or obligations or meet expected deadlines, or if the quality, completeness or accuracy of the clinical data they obtain is compromised due to the failure to adhere to our clinical protocols or for other reasons, our clinical trials may have to be extended, delayed or terminated. Many of these factors would be beyond our control. We may not be able to enter into replacement arrangements without undue delays or considerable expenditures. If there are delays in testing or approvals as a result of the failure to perform by third parties, our research and development costs would increase, and we may not be able to obtain regulatory clearance or approval for our tests. In addition, we may not be able to establish or maintain relationships with these parties on favorable terms, if at all. Each of these outcomes would harm our ability to market our tests or to achieve or sustain profitability.

The FDA requires medical device manufacturers to comply with, among other things, current good manufacturing practices for medical devices, set forth in the Quality System Regulation at 21 C.F.R. Part 820, which requires manufacturers to follow elaborate design, testing, control, documentation and other quality assurance procedures during the manufacturing process; the medical device reporting regulation, which requires that manufacturers report to the FDA if their device or a similar device they market may have caused or contributed to a death or serious injury or malfunctioned in a way that would likely cause or contribute to a death or serious injury if it were to recur; labeling regulations, including the FDA's general prohibition against promoting products for unapproved or "off-label" uses; the reports of corrections and removals regulation, which requires manufacturers to report to the FDA if a device correction or removal was initiated to reduce a risk to

health posed by the device or to remedy a violation of the FDC Act caused by the device which may present a risk to health; and the establishment registration and device listing regulation.

Moreover, there can be no assurance that any cleared or approved labeling claims will be consistent with our current claims or adequate to support continued adoption of our products. If premarket review is required for some or all of our products, the FDA may require that we stop selling our products pending clearance or approval, which would negatively impact our business. Even if our products are allowed to remain on the market prior to clearance or approval, demand for our products may decline if there is uncertainty about our products, if we are required to label our products as investigational by the FDA, or if the FDA limits the labeling claims we are permitted to make for our products. As a result, we could experience significantly increased development costs and a delay in generating additional revenues from our services, or from other services or products now in development.

In addition, any clearance or approval we obtain for our products may contain requirements for costly post-market testing and surveillance to monitor the safety or efficacy of the product. The FDA has broad post-market enforcement powers, and if unanticipated problems with our products arise, or if we or our suppliers fail to comply with regulatory requirements following FDA clearance or approval, we may become subject to enforcement actions such as:

- restrictions on manufacturing processes;
- restrictions on product marketing;
- warning letters;
- withdrawal or recall of products from the market;
- refusal to approve pending PMAs, 510(k)s, or supplements to approved PMAs or cleared 510(k)s that we submit;
- fines, restitution or disgorgement of profits or revenue;
- suspension or withdrawal of regulatory clearances or approvals;
- limitation on, or refusal to permit, import or export of our products;
- product seizures;
- injunctions; or
- imposition of civil or criminal penalties.

Moreover, the FDA strictly regulates the promotional claims that may be made about medical devices. In particular, a medical device may not be promoted for uses that are not approved by the FDA as reflected in the device's approved labeling. However, companies may share truthful and not misleading information that is otherwise consistent with the product's FDA approved labeling. The FDA and other agencies actively enforce the laws and regulations prohibiting the promotion of off-label uses, and a company that is found to have improperly promoted off-label uses may be subject to significant civil, criminal and administrative penalties.

Failure to comply with federal, state, and foreign laboratory licensing requirements and the applicable requirements of the FDA or any other regulatory authority, could cause us to lose the ability to perform our tests, experience disruptions to our business, or become subject to administrative or judicial sanctions.

We are subject to CLIA, a federal law that regulates clinical laboratories that perform testing on specimens derived from humans for the purpose of providing information for the diagnosis, prevention, or treatment of disease. CLIA regulations establish specific standards with respect to personnel qualifications, facility

administration, proficiency testing, quality control, quality assurance, and inspections. We have a current CLIA certificate to conduct our tests at our laboratory in Menlo Park, California. To renew this certificate, we are subject to survey and inspection every two years. Moreover, CLIA inspectors may make random inspections of our clinical reference laboratory.

We are also required to maintain a license to conduct testing in California. California laws establish standards for day-to-day operation of our clinical reference laboratory in Menlo Park, including the training and skills required of personnel and quality control. Several other states in which we operate also require that we hold licenses to test specimens from patients in those states, under certain circumstances. For example, our clinical reference laboratory is required to be licensed on a product-specific basis by New York as an out-of-state laboratory, and our products, as LDTs, must be approved by the New York State Department of Health (the "NYDOH") on a product-by-product basis before they are offered in New York. We are subject to periodic inspection by the NYDOH and are required to demonstrate ongoing compliance with NYDOH regulations and standards. To the extent NYDOH identified any non-compliance and we are unable to implement satisfactory corrective actions to remedy such non-compliance, the State of New York could withdraw approval for our tests. Additionally, states such as Maryland, Pennsylvania, and Rhode Island may also require us to maintain out-of-state licenses. Other states may have similar requirements or may adopt similar requirements in the future. Although we have obtained licenses from states where we believe we are required to be licensed, we may become aware of other states that require out-of-state laboratories to obtain licensure in order to accept specimens from the state, and it is possible that other states currently have such requirements or will have such requirements in the future. We may also be subject to regulation in foreign jurisdictions as we seek to expand international utilization of our tests or such jurisdictions adopt new licensure requirements, which may require review of our tests in order to offer them or may have other limitations such as restrictions on the transport of human blood necessary for us to perform our tests that may limit our ability to make our tests available outside of the United States. Complying with licensure requirements in new jurisdictions may be expensive and/or time-consuming, may subject us to significant and unanticipated delays, or may be in conflict with other applicable requirements.

Failure to comply with applicable clinical laboratory licensure requirements may result in a range of enforcement actions, including license suspension, limitation, or revocation, directed plan of action, onsite monitoring, civil monetary penalties, and criminal sanctions as well as significant adverse publicity. Any sanction imposed under CLIA, its implementing regulations or state or foreign laws or regulations governing clinical laboratory licensure, or our failure to renew our CLIA certificate, a state or foreign license or accreditation, could have a material adverse effect on our business, financial condition and results of operations. Even if we were able to bring our laboratory back into compliance, we could incur significant expenses and potentially lose revenues in doing so.

Although we market our tests as LDTs that are currently subject to the FDA's exercise of enforcement discretion, if we fail to operate within the conditions of that exercise of enforcement discretion, or if any of our products otherwise fail to comply with FDA regulatory requirements as enforced, we would be subject to the applicable requirements of the FDC Act and the FDA's implementing regulations. The FDA is empowered to impose sanctions for violations of the FDC Act and the FDA's implementing regulations, including warning letters, civil and criminal penalties, injunctions, product seizure or recall, import bans, restrictions on the conduct of our operations and total or partial suspension of production. Any of the aforementioned sanctions could cause reputational damage, undermine our ability to maintain and increase our revenues, and harm our business, financial condition, and results of operations. In particular, if we or the FDA discover that any of our products have defects that call into question the accuracy of their results, we may be required to undertake a retest of all results and analyses provided during the period relevant to the defect, or recall the affected products. The direct costs incurred in connection with such a recall in terms of management time, administrative and legal expenses and lost revenue, together with the indirect costs to our reputation could harm our business, financial condition and results of operations, and our ability to execute our business strategy. While we believe that we are currently in material compliance with applicable laws and regulations as currently enforced, the FDA or other regulatory

agencies may not agree, and a determination that we have violated these laws or a public announcement that we are being investigated for possible violations of these laws could adversely affect our business, financial condition, results of operations, and prospects.

Complying with numerous statutes and regulations pertaining to our business is an expensive and time- consuming process, and any failure to comply could result in substantial penalties.

Our operations may be subject to other extensive federal, state, local, and foreign laws and regulations, all of which are subject to change. These laws and regulations currently include, among others:

- the federal Anti-Kickback Statute, which prohibits knowingly and willfully offering, paying, soliciting, or receiving remuneration, directly or indirectly, overtly or covertly, in cash or in kind, in return for or to induce such person to refer an individual, or to purchase, lease, order, arrange for, or recommend purchasing, leasing or ordering, any good, facility, item or service that is reimbursable, in whole or in part, under a federal healthcare program. A person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation. In addition, the government may assert that a claim including items or services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the false claims statutes;
- the federal Stark physician self-referral law, which prohibits a physician from making a referral for certain designated health services covered by the Medicare program, including laboratory and pathology services, if the physician or an immediate family member has a financial relationship with the entity providing the designated health services, and prohibits that entity from billing or presenting a claim for the designated health services furnished pursuant to the prohibited referral, unless an exception applies. Failure to refund amounts received as a result of a prohibited referral on a timely basis may constitute a false or fraudulent claim under the False Claims Act;
- the "Anti-Markup Rule" and similar state and similar state laws, among other things, prohibits a physician or supplier billing the Medicare program from marking up the price of a purchased diagnostic service performed by another laboratory or supplier that does not "share a practice" with the billing physician or supplier. Penalties may apply to the billing physician or supplier if Medicare or another payer is billed at a rate that exceeds the performing laboratory's charges to the billing physician or supplier, and the performing laboratory could be at risk under false claims laws, described below, for causing the submission of a false claim;
- the federal civil and criminal false claims laws, including the False Claims Act, which impose liability on any person or entity that, among other things, knowingly presents, or causes to be presented, a false or fraudulent claim for payment to the federal government. These laws can apply to entities that provide information on coverage, coding, and reimbursement of their products and assistance with obtaining reimbursement to persons who bill payors. Private individuals can bring False Claims Act "qui tam" actions, on behalf of the government and such individuals, commonly known as "whistleblowers," may share in amounts paid by the entity to the government in fines or settlement;
- the federal Civil Monetary Penalties Law, which prohibits, among other things, the offering or transfer of remuneration to a Medicare or state healthcare program beneficiary if the person knows or should know it is likely to influence the beneficiary's selection of a particular provider, practitioner, or supplier of services reimbursable by Medicare or a state healthcare program, unless an exception applies;
- the federal Physician Payments Sunshine Act, which requires certain manufacturers of drugs, biologicals, and medical devices or supplies that require premarket approval by or notification to the FDA, and for which payment is available under Medicare, Medicaid or the Children's Health Insurance Program ("CHIP") to report annually to CMS information related to (i) payments and other transfers of value to physicians and teaching hospitals, and (ii) ownership and investment interests held by physicians and their immediate family members;

- the HIPAA fraud and abuse provisions, which created federal civil and criminal statutes that prohibit, among other things, defrauding healthcare programs, willfully obstructing a criminal investigation of a healthcare offense and falsifying or concealing a material fact or making any materially false statements in connection with the payment for healthcare benefits, items or services. Similar to the federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- the Eliminating Kickbacks in Recovery Act of 2018 ("EKRA"), which prohibits payments for referrals to recovery homes, clinical treatment facilities, and laboratories. EKRA's reach extends beyond federal health care programs to include private insurance (i.e., it is an "all payer" statute);
- other federal and state fraud and abuse laws, such as anti-kickback laws, prohibitions on self-referral, fee-splitting restrictions, insurance fraud laws, prohibitions on the provision of tests at no or discounted cost to induce physician or patient adoption, and false claims acts, which may extend to services reimbursable by any payer, including private insurers;
- the prohibition on reassignment of Medicare claims, which, subject to certain exceptions, precludes the reassignment of Medicare claims to any other party;
- state laws that prohibit other specified practices, such as billing physicians for testing that they order; waiving coinsurance, copayments, deductibles, and other amounts owed by patients; billing a state Medicaid program at a price that is higher than what is charged to one or more other payors employing, exercising control over, licensed professionals in violation of state laws prohibiting corporate practice of medicine and other professions, and prohibitions against the splitting of professional fees with licensed professionals; and
- similar foreign laws and regulations that apply to us in the countries in which we operate or may operate in the future.

As a clinical laboratory, our business practices may face additional scrutiny from government regulatory agencies such as the Department of Justice, the HHS Office of Inspector General (the "OIG") and CMS. Certain arrangements between clinical laboratories and referring physicians have been identified in fraud alerts issued by the OIG as implicating the Anti-Kickback Statute. The OIG has stated that it is particularly concerned about these types of arrangements because the choice of laboratory, as well as the decision to order laboratory tests, typically are made or strongly influenced by the physician, with little or no input from patients. Moreover, the provision of payments or other items of value by a clinical laboratory to a referral source could be prohibited under the Stark Law unless the arrangement meets all criteria of an applicable exception. The government has been active in enforcement of these laws as they apply to clinical laboratories.

The growth of our business and our expansion outside of the United States may increase the potential of violating these laws or our internal policies and procedures. The risk of our being found in violation of these or other laws and regulations is further increased by the fact that many have not been fully interpreted by the regulatory authorities or the courts, and their provisions are open to a variety of interpretations. Any action brought against us for violation of these or other laws or regulations, even if we successfully defend against it, could cause us to incur significant legal expenses and reputational harm and divert our management's attention from the operation of our business. If our operations are found to be in violation of any of these laws and regulations, we may be subject to any applicable penalty associated with the violation, including significant administrative, civil and criminal penalties, damages, fines, imprisonment, exclusion from participation in federal healthcare programs, refunding of payments received by us, integrity oversight and reporting obligations, and curtailment or cessation of our operations. Any of the foregoing consequences could seriously harm our business and our financial results.

If we decide to grow our business by developing in vitro diagnostic tests, we may be subject to reimbursement challenges.

The coverage and reimbursement status of newly approved or cleared laboratory tests is uncertain. If we develop in vitro diagnostic tests and decide to seek reimbursement, and if such tests are inadequately covered by insurance and ineligible for such reimbursement, this could limit our ability to market any such future tests. The commercial success of future products in both domestic and international markets may depend in part on the availability of coverage and adequate reimbursement from third-party payors, including government payors, such as the Medicare and Medicaid programs, managed care organizations, and other third-party payors. The government and other third-party payors are increasingly attempting to contain health care costs by limiting both insurance coverage and the level of reimbursement for new diagnostic tests. As a result, they may not cover or provide adequate payment for any future in vitro diagnostic tests that we develop. These payors may conclude that our products are less safe, less effective, or less cost-effective than existing or later-introduced products. These payors may also conclude that the overall cost of using one of our tests exceeds the overall cost of using a competing test, and third-party payors may not approve any future in vitro diagnostic tests we develop for insurance coverage and adequate reimbursement.

We could be adversely affected by violations of the Foreign Corrupt Practices Act of 1977, as amended (the "FCPA"), and other worldwide anti-bribery laws.

We are subject to the FCPA, which prohibits companies and their intermediaries from making payments in violation of law to non-U.S. government officials for the purpose of obtaining or retaining business or securing any other improper advantage. Other U.S. companies in the medical device and pharmaceutical fields have faced criminal penalties under the FCPA for allowing their agents to deviate from appropriate practices in doing business with these individuals. We are also subject to similar anti-bribery laws in the jurisdictions in which we operate, including the United Kingdom's Bribery Act of 2010, which also prohibits commercial bribery and makes it a crime for companies to fail to prevent bribery. These laws are complex and far-reaching in nature, and, as a result, we cannot assure you that we would not be required in the future to alter one or more of our practices to be in compliance with these laws or any changes in these laws or the interpretation thereof. Any violations of these laws, or allegations of such violations, could disrupt our operations, involve significant management distraction, involve significant costs and expenses, including legal fees, and could result in a material adverse effect on our business, prospects, financial condition or results of operations. We could also incur severe penalties, including criminal and civil penalties, disgorgement, and other remedial measures.

Expansion into international markets would subject us to increased regulatory oversight and regulatory, economic, social and political uncertainties, which could cause a material adverse effect on our business, financial position, and results of operations.

We may in the future expand our business and operations into international jurisdictions in which we have limited operating experience, including with respect to seeking regulatory approvals and marketing and selling products and services. If we expand internationally, our operations in these jurisdictions may be adversely affected by general economic conditions and economic and fiscal policy, including changes in exchange rates and controls, interest rates and taxation policies, increased government regulation, social stability and political, economic or diplomatic developments in the future. Certain jurisdictions have, from time to time, experienced instances of civil unrest and hostilities, both internally and with neighboring countries. Rioting, military activity, terrorist attacks, or armed hostilities could cause our operations in such jurisdictions to be adversely affected or suspended. We generally do not have insurance for losses and interruptions caused by terrorist attacks, military conflicts and wars. In addition, anti-bribery and anti-corruption laws may conflict with some local customs and practices in foreign jurisdictions. Our international operations may subject us to heightened scrutiny under the FCPA, the UK Bribery Act and similar anti-bribery laws, and could subject us to liability under such laws despite our best efforts to comply with such laws. As a result of our policy to comply with the FCPA, the UK Bribery Act and similar anti-bribery laws, we may be at a competitive disadvantage to competitors that are not subject to,

or do not comply with, such laws. Further, notwithstanding our compliance programs, there can be no assurances that our policies will prevent our employees or agents from violating these laws or protect us from any such violations. Additionally, we cannot predict the nature, scope or impact of any future regulatory requirements that may apply to our international operations or how foreign governments will interpret existing or new laws. Alleged, perceived or actual violations of any such existing or future laws by us or due to the acts of others, may result in criminal or civil sanctions, including contract cancellations or debarment, and damage to our reputation, any of which could have a material adverse effect on our business.

Changes in health care policy could increase our costs, decrease our revenues, and impact sales of and reimbursement for our tests.

In March 2010, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act (the "ACA"), became law. This law substantially changed the way health care is financed by both commercial payers and government payers, and significantly impacts our industry. The ACA contains a number of provisions that are expected to impact the business and operations of our customers, some of which in ways we cannot currently predict, including those governing enrollment in state and federal health care programs, reimbursement changes and fraud and abuse, which will impact existing state and federal health care programs and will result in the development of new programs.

Among other things, the ACA:

- imposed an annual excise tax of 2.3% on any entity that manufactures or imports medical devices offered for sale in the United States, with limited exceptions, although the effective rate paid may be lower. Under the Consolidated Appropriations Act of 2016, the excise tax was suspended through December 31, 2017, and under the continuing resolution on appropriations for fiscal year 2018, signed by President Trump on January 22, 2018, was further suspended through December 31, 2019;
- expanded eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to additional individuals and by adding new mandatory eligibility categories for individuals with income at or below 133% of the federal poverty level, thereby potentially increasing manufacturers' Medicaid rebate liability;
- established a new Patient-Centered Outcomes Research Institute to oversee and identify priorities in comparative clinical efficacy research in an effort to coordinate and develop such research; and
- established a Center for Medicare & Medicaid Innovation at CMS to test innovative payment and service delivery models to lower Medicare and Medicaid spending.

Some of the provisions of the ACA have yet to be implemented, and there have been judicial and Congressional challenges to certain aspects of the ACA, as well as recent efforts by the Trump administration to repeal or replace certain aspects of the ACA. Since January 2017, President Trump has signed two Executive Orders and other directives to delay the implementation of certain requirements of the ACA. Concurrently, Congress has considered legislation that would repeal or repeal and replace all or part of the ACA. While Congress has not passed comprehensive repeal legislation, it has enacted laws that modify certain provisions of the ACA such as removing penalties, starting January 1, 2019, for not complying with the ACA's individual mandate to carry health insurance and delaying the implementation of certain ACA-mandated fees including, without limitation, the medical device excise tax. On December 14, 2018, a Texas U.S. District Court Judge ruled that the ACA is unconstitutional in its entirety because the "individual mandate" was repealed by Congress as part of the Tax Cuts and Jobs Act. While the Texas U.S. District Court Judge, as well as the Trump administration and CMS, have stated that the ruling will have no immediate effect pending appeal of the decision, it is unclear how this decision, subsequent appeals, and other efforts to repeal and replace the ACA will impact the ACA and our business. Additional legislation may be enacted that further amends, or repeals, the ACA, which could result in lower numbers of insured individuals, reduced coverage for insured individuals and adversely affect our and our customers' business.

In addition, other legislative changes have been proposed and adopted since the Affordable Care Act was enacted. On August 2, 2011, the Budget Control Act of 2011 was signed into law, which, among other things, reduced Medicare payments to providers by 2% per fiscal year, effective on April 1, 2013 and, due to subsequent legislative amendments to the statute, will remain in effect through 2027 unless additional Congressional action is taken. On January 2, 2013, the American Taxpayer Relief Act of 2012 was signed into law, which, among other things, reduced Medicare payments to several providers, including hospitals, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. The Medicare Access and CHIP Reauthorization Act of 2015, enacted on April 16, 2015 ("MACRA"), repealed the formula by which Medicare made annual payment adjustments to physicians and replaced the former formula with fixed annual updates and a new system of incentive payments scheduled to begin in 2019 that are based on various performance measures and physicians' participation in alternative payment models such as accountable care organizations.

In April 2014, Congress passed the Protecting Access to Medicare Act of 2014 ("PAMA"), which included substantial changes to the way in which clinical laboratory services are paid under Medicare. Under PAMA, laboratories that receive the majority of their Medicare revenue from payments made under the Medicare Clinical Laboratory Fee Schedule, or the Physician Fee Schedule are required to report to CMS, beginning in 2017 and every three years thereafter (or annually for "advanced diagnostic laboratory tests"), private payer payment rates and volumes for their tests. CMS will use this data to calculate a weighted median payment rate for each test, which will be used to establish revised Medicare reimbursement rates for the tests. Laboratories that fail to report the required payment information may be subject to substantial civil monetary penalties. It is unclear what impact new quality and payment programs, such as MACRA, or new pricing structures, such as those adopted under PAMA, may have on our business, financial condition, results of operations, or cash flows.

We anticipate there will continue to be proposals by legislators at both the federal and state levels, regulators and private payers to reduce costs while expanding individual healthcare benefits. Certain of these changes could impose additional limitations on the prices we will be able to charge for our tests, the coverage of or the amounts of reimbursement available for our tests from payers, including commercial payers and government payers.

If we use hazardous materials in a manner that causes injury, we could be liable for resulting damages.

Our activities currently require the use of hazardous chemicals and biological material. We cannot eliminate the risk of an accidental environmental release or injury to employees or third parties from the use, storage, handling, or disposal of these materials. In the event of an environmental release or injury, we could be held liable for any resulting damages, and any liability could exceed our resources or any applicable insurance coverage we may have. Additionally, we are subject on an ongoing basis to federal, state and local laws and regulations governing the use, storage, handling and disposal of these materials and specified waste products. The cost of maintaining compliance with these laws and regulations may become significant, and our failure to comply may result in substantial fines or other consequences, and either could negatively affect our operating results.

Risks Related to Our Intellectual Property

Litigation or other proceedings or third-party claims of intellectual property infringement, misappropriation or other violations may require us to spend significant time and money, and could in the future prevent us from selling our tests or impact our stock price, any of which could have a material adverse effect.

Our commercial success will depend in part on our avoiding infringement of patents and infringement, misappropriation or other violations of other proprietary rights of third parties, including for example the intellectual property of competitors. There is extensive intellectual property litigation involving the

biotechnology and pharmaceutical industries and genetic sequencing technology. Our activities may be subject to claims that we infringe or otherwise violate patents owned or controlled by third parties. Numerous U.S. and foreign patents and pending patent applications exist in the genetic testing market and are owned by third parties. We cannot assure you that our operations do not, or will not in the future, infringe existing or future patents. For example, we are aware of several third-party issued U.S. patents and pending patent applications with claims relating to genetic sequencing technology and methodology that may be asserted against us and may be construed to encompass our products and services, including ACE ImmunoID and ImmunoID NeXT technology. In order to avoid infringing these third-party patents, we may find it necessary to or prudent to initiate invalidity proceedings against such patents or to obtain licenses from such third-party intellectual property holders. If we are not able to invalidate such patents or obtain or maintain a license on commercially reasonable terms and such third parties assert infringement claims against us, we may be prevented from exploiting our technology and our business, financial condition, results of operations, and prospects may be materially and adversely affected. We may also be unaware of patents that a third party, including for example a competitor in the genetic testing market, might assert are infringed by our business. There may also be patent applications that, if issued as patents, could be asserted against us. Patent applications in the United States and elsewhere are typically published approximately 18 months after the earliest filing for which priority is claimed, with such earliest filing date being commonly referred to as the priority date. Certain U.S. patent applications that will not be filed outside the United States can remain confidential until patents issue. Therefore, patent applications covering our products, services, or technologies could have been filed by third parties without our knowledge. Additionally, pending patent applications that have been published can, subject to certain limitations, be later amended in a manner that could cover our products, services, technologies, and their use. The scope of a patent claim is determined by an interpretation of the law, the written disclosure in a patent and the patent's prosecution history and can involve other factors such as expert opinion. Our interpretation of the relevance or the scope of claims in a patent or a pending application may be incorrect, which may negatively impact our ability to market our products and services. Further, we may incorrectly determine that our technologies, products, or services are not covered by a third-party patent or may incorrectly predict whether a third party's pending patent application will issue with claims of relevant scope. Our determination of the expiration date of any patent in the United States or abroad that we consider relevant may be incorrect, which may negatively impact our ability to develop and market our products or services.

Third-party intellectual property right holders may also actively bring infringement or other intellectual property-related claims against us, even if we have received patent protection for our technologies, products, and services. Regardless of the merit of third parties claims against us for infringement, misappropriation or violations of their intellectual property rights, such third parties may seek and obtain injunctive or other equitable relief, which could effectively block our ability to perform our tests. Further, if a patent infringement suit were brought against us, we could be forced to stop or delay our development or sales of any tests or other activities that are the subject of such suit. Defense of these claims, even if such claims are resolved in our favor, could cause us to incur substantial expenses and be a substantial diversion of our employee resources even if we are ultimately successful. Any adverse ruling or perception of an adverse ruling in defending ourselves could have a material adverse impact on our cash position and stock price. Such litigation or proceedings could substantially increase our operating losses and reduce the resources available for development activities or any future sales, marketing, or distribution activities. We may not have sufficient financial or other resources to conduct such litigation or proceedings adequately. Some of our competitors may be able to sustain the costs of such litigation or proceedings more effectively than we can because of their greater financial resources and more mature and developed intellectual property portfolios.

As we continue to commercialize our tests in their current or an updated form, launch different and expanded tests and enter new markets, other competitors might claim that our tests infringe, misappropriate or violate their intellectual property rights as part of business strategies designed to impede our successful commercialization and entry into new markets. If such a suit were brought, regardless of merit, there is no assurance that a court would find in our favor on questions of infringement, validity, enforceability or priority. Even if we are successful in defending against such suit, we could incur substantial costs and diversion of the

attention of our management and technical personnel in defending ourselves against such claims. A court of competent jurisdiction could hold that third-party patents asserted against us are valid, enforceable, and infringed, which could materially and adversely affect our ability to commercialize any products, services or technologies we may develop and any other technologies covered by the asserted third-party patents and any adverse ruling or perception of an adverse ruling in defending ourselves could have a material adverse impact on our cash position and stock price. If we are found to infringe, misappropriate or otherwise violate a third party's intellectual property rights, and we are unsuccessful in demonstrating that such rights are invalid or unenforceable, we may be required to pay substantial damages, including treble damages and attorneys' fees for willful infringement; obtain one or more licenses from third parties in order to continue developing and marketing our products and technology, which may not be available on commercially reasonable terms (if at all) or may be non-exclusive, thereby giving our competitors and other third parties access to the same technologies licensed to us; pay substantial royalties and other fees; and redesign any infringing tests or other activities, which may be impossible or require substantial time and monetary expenditure, or be prohibited from commercializing certain tests, all of which could have a material adverse effect on our business, financial condition, results of operations, and prospects.

Where we collaborate with third parties in the development of technology, our collaborators may not properly maintain or defend our intellectual property rights or may use our proprietary information in such a way as to invite litigation that could jeopardize or invalidate our intellectual property or proprietary information. Further, collaborators may infringe the intellectual property rights of third parties, which may expose us to litigation and potential liability. Also, we may be obligated under our agreements with our collaborators, licensors, suppliers and others to indemnify and hold them harmless for damages arising from intellectual property infringement by us.

If we cannot license rights to use technologies on reasonable terms, we may not be able to commercialize new products in the future.

In the future, we may identify additional third-party intellectual property we may need to license in order to engage in our business, including to develop or commercialize new products or services. However, such licenses may not be available on acceptable terms or at all. Even if such licenses are available, we may be required to pay the licensor substantial royalties based on sales of our products and services. Such royalties are a component of the cost of our products or services and may affect the margins on our products and services. In addition, such licenses may be nonexclusive, which could give our competitors access to the same intellectual property licensed to us. If we are unable to enter into the necessary licenses on acceptable terms or at all, if any necessary licenses are subsequently terminated, if our licensors fail to abide by the terms of the licenses, if our licensors fail to prevent infringement by third parties, or if the licensed patents or other rights are found to be invalid or unenforceable, our business, financial condition, results of operations, and prospects could be materially and adversely affected.

If licenses to third-party intellectual property rights are or become required for us to engage in our business, the rights may be non-exclusive, which could give our competitors access to the same technology or intellectual property rights licensed to us. Moreover, we could encounter delays in the introduction of tests while we attempt to develop alternatives. Defense of any lawsuit or failure to obtain any of these licenses on favorable terms could prevent us from commercializing tests, which could materially affect our ability to grow and thus adversely affect our business and financial condition.

Developments or uncertainty in the patent statute, patent case law or U.S. Patent and Trademark Office ("USPTO"), rules and regulations may impact the validity, scope or enforceability of our patent rights, thereby impairing our ability to protect our products.

Our patent rights, their associated costs, and the enforcement or defense of such patent rights may be affected by developments or uncertainty in the patent statute, patent case law or USPTO rules and regulations.

There are a number of recent changes to the patent laws that may have a significant impact on our ability to protect our technology and enforce our intellectual property rights. For example, the Leahy-Smith America Invents Act (the "AIA") enacted within the last several years involves significant changes in patent legislation. These include provisions that affect the way patent applications will be prosecuted and may also affect patent litigation. As an example, assuming that other requirements for patentability are met, prior to March 2013, in the United States, the first to invent the claimed invention was entitled to the patent, while outside the United States, the first to file a patent application was entitled to the patent. On or after March 16, 2013, under the AIA, the United States transitioned to a first inventor to file system in which, assuming that other requirements for patentability are met, means that the party that is first to file in the United States generally is awarded the patent rights, regardless of whether such party invented the claimed invention first.

The AIA also includes a number of significant changes that affect the way patent applications will be prosecuted and also may affect patent litigation. These include allowing third party submission of prior art to the USPTO during patent prosecution and additional procedures to attack the validity of a patent by USPTO administered post-grant proceedings, including post-grant review, *inter partes* review, and derivation proceedings. Because of a lower evidentiary standard in USPTO proceedings compared to the evidentiary standard in United States federal courts necessary to invalidate a patent claim, a third party could potentially provide evidence in a USPTO proceeding sufficient for the USPTO to hold a claim invalid even though the same evidence would be insufficient to invalidate the claim if first presented in a district court action. Accordingly, a third party may attempt to use the USPTO procedures to invalidate our patent claims that would not have been invalidated if first challenged by the third party as a defendant in a district court action. The AIA and its implementation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents, all of which could have a material adverse effect on our business, financial condition, results of operations, and prospects.

Further, the standards applied by the USPTO and foreign patent offices in granting patents are not always applied uniformly or predictably. For example, there is no uniform worldwide policy regarding patentable subject matter or the scope of claims allowable in biotechnology patents. As such, we do not know the degree of future protection that we will have on our technologies, products, and services. While we will endeavor to try to protect our technologies, products, and services with intellectual property rights such as patents, as appropriate, the process of obtaining patents is time-consuming, expensive, and sometimes unpredictable.

In addition, the patent position of companies engaged in the development and commercialization of diagnostic tests is particularly uncertain. Various courts, including the Supreme Court have rendered decisions that affect the scope of patentability of certain inventions or discoveries relating to certain diagnostic tests and related methods. These decisions state, among other things, that a patent claim that recites an abstract idea, natural phenomenon or law of nature (for example, the relationship between particular genetic variants and cancer) are not themselves patentable. Precisely what constitutes a law of nature or abstract idea is uncertain, and it is possible that certain aspects of genetic diagnostics tests would be considered natural laws. Accordingly, the evolving case law in the United States may adversely affect our ability to obtain patents and may facilitate third-party challenges to any owned or licensed patents. The laws of some foreign countries do not protect intellectual property rights to the same extent as the laws of the United States, and we may encounter difficulties in protecting and defending such rights in foreign jurisdictions. The legal systems of many other countries do not favor the enforcement of patents and other intellectual property protection, particularly those relating to biotechnology, which could make it difficult for us to stop the infringement of our patents in such countries. Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial cost and divert our efforts and attention from other aspects of our business.

Patent terms may be inadequate to protect our competitive position for an adequate amount of time.

Patents have a limited lifespan. In the United States, the natural expiration of a patent is generally 20 years after its first effective non-provisional filing date. Although various extensions may be available, the life of a

patent, and the protection it affords, is limited. Even if patents covering our technologies, products, and services are obtained, once the patent life has expired, we may be open to competition from competitive products. Our issued patents will expire on dates ranging from 2033 to 2035, subject to any patent extensions that may be available for such patents. If patents are issued on our pending patent applications, the resulting patents are projected to expire on dates ranging from 2033 to 2038. In addition, although upon issuance in the United States a patent's life can be increased based on certain delays caused by the USPTO, this increase can be reduced or eliminated based on certain delays caused by the patent applicant during patent prosecution. If we do not have sufficient patent life to protect our technologies, products and services, our competitive position, business, financial condition, results of operations, and prospects will be adversely affected.

If we are not able to obtain and enforce patent protection for any products we develop and for our technologies, or if the scope of patent protection obtained is not sufficiently broad, our competitors and other third parties could develop and commercialize products and technology similar or identical to ours, and our ability to successfully commercialize our products, services, and technologies may be adversely affected.

We have applied, and we intend to continue applying, for patents covering such aspects of our technologies as we deem appropriate. However, the patent process is expensive, time consuming and complex, and we may not be able to apply for patents on certain aspects of our services, products, and other technologies in a timely fashion, at a reasonable cost, in all jurisdictions or at all, and any potential patent coverage we obtain may not be sufficient to prevent substantial competition.

Moreover, the patent position of biotechnology companies can be highly uncertain because it involves complex legal and factual questions for which important legal principles remain unresolved. No consistent policy regarding the breadth of claims allowed in such companies' patents has emerged to date in the United States or elsewhere. Courts frequently render opinions in the biotechnology field that may affect the patentability of certain inventions or discoveries, including opinions that may affect the patentability of methods for analyzing nucleic acid sequences.

Others may independently develop similar or alternative technologies or design around technologies for which we may not be able to obtain patent protection. In addition, any patent applications we file may be challenged and may not result in issued patents or may be invalidated, rendered unenforceable or narrowed in scope after they are issued, and there is no guarantee any of our issued patents include or will include claims that are sufficiently broad to cover our products, services and other technologies or to provide meaningful protection from our competitors. Consequently, we do not know whether any of our platform advances, products, services and other technologies will be protectable or remain protected by valid and enforceable patents. Our competitors or other third parties may be able to circumvent our patents by developing similar or alternative technologies or products in a non-infringing manner.

Even if they are unchallenged, our patents and patent applications may not adequately protect our intellectual property, provide exclusivity for our technologies, products, and services, or prevent others from designing around our claims. Any finding that our patents or applications are invalid, unpatentable or unenforceable could harm our ability to prevent others from practicing the related technology, and a finding that others have inventorship or ownership rights to our patents and applications could require us to obtain certain rights to practice related technologies, which may not be available on favorable terms, if at all. If we initiate lawsuits to protect or enforce our patents, or litigate against third-party claims, which would be expensive, and, if we lose, we may lose some of our intellectual property rights. Furthermore, these lawsuits may divert the attention of our management and technical personnel. Any of the foregoing could have a material adverse effect on our competitive position, business, financial condition, results of operations, and prospects

Once granted, patents may remain open to opposition, interference, re-examination, post-grant review, *inter partes* review, nullification or derivation action in court or before patent offices or similar proceedings for a

given period after allowance or grant, during which time third parties can raise objections against such initial grant. In the course of such proceedings, which may continue for a protracted period of time, the patent owner may be compelled to limit the scope of the granted claims thus attacked, or may lose the granted claims altogether. An adverse determination in any such proceeding or litigation could reduce the scope of, or invalidate, our patent rights, allow third parties to commercialize our technology or products and compete directly with us, without payment to us, or result in our inability to commercialize our products, services and technologies without infringing third-party patent rights. Such proceedings also may result in substantial cost and require significant time from our scientists and management, even if the eventual outcome is favorable to us. If the breadth or strength of protection provided by our patents and patent applications is threatened, regardless of the outcome, it could dissuade companies from collaborating with us to license, develop or commercialize current or future products or technologies. In addition, there can be no assurance that:

- others will not or may not be able to make, use, offer to sell, or sell tests that are the same as or similar to our products or services but that are not covered by the claims of the patents that we own or license;
- we or our future licensors or collaborators are the first to make the inventions covered by each of our issued patents and pending patent applications that we own or license;
- we or our future licensors or collaborators are the first to file patent applications covering certain aspects of our inventions;
- others will not independently develop similar or alternative technologies or duplicate any of our technologies without infringing our intellectual property rights;
- a third party may not challenge our patents and, if challenged, a court would hold that our patents are valid, enforceable, and infringed;
- any issued patents that we own or may license will provide us with any competitive advantages, or will not be challenged by third parties;
- we may develop or in-license additional proprietary technologies that are patentable;
- pending patent applications that we own or may license will lead to issued patents;
- the patents of others will not have a material or adverse effect on our business, financial condition, results of operations, and prospects; and
- our competitors do not conduct research and development activities in countries where we do not have enforceable patent rights and then use the information learned from such activities to develop competitive products for sale in our major commercial markets.

The issuance of a patent is not conclusive as to its inventorship, scope, validity, or enforceability. Some of our patents or patent applications may be challenged at a future point in time in opposition, derivation, reexamination, *inter partes* review, post-grant review, or interference proceedings. Any successful opposition to these patents or any other patents owned by or, if applicable in the future, licensed to us could deprive us of rights necessary for the practice of our technologies or the successful commercialization of any products or technologies that we may develop, which could lead to increased competition to our business and harm our business. Since patent applications in the United States and most other countries are confidential for a period of time after filing, we cannot be certain that we or our licensors were the first to file any patent application related to our technologies, products, or services. Furthermore, an interference proceeding can be provoked by a third party or instituted by the USPTO to determine who was the first to invent any of the subject matter covered by the patent claims of our applications for any application with an effective filing date before March 16, 2013.

Where we obtain licenses from or collaborate with third parties, in some circumstances, we may not have the right to control the preparation, filing, and prosecution of patent applications, or to maintain the patents, covering technology that we license from third parties. We may also require the cooperation of our licensors and collaborators to enforce any licensed patent rights, and such cooperation may not be provided. Therefore, these

patents and applications may not be prosecuted and enforced in a manner consistent with the best interests of our business. Moreover, if we do obtain necessary licenses, we will likely have obligations under those licenses, and any failure to satisfy those obligations could give our licensor the right to terminate the license. Termination of a necessary license could have a material adverse impact on our business.

It is also possible that we fail to file patent applications covering inventions made in the course of development and commercialization activities before a competitor or another third party files a patent application covering, or publishes information disclosing, a similar, independently-developed invention. Such competitor's patent application may pose obstacles to our ability to obtain or limit the scope of patent protection we may obtain. Although we enter into non-disclosure and confidentiality agreements with parties who have access to confidential or patentable aspects of our research and development output, such as our employees, collaborators, contract manufacturers, consultants, advisors, and other third parties, any of these parties may breach the agreements and disclose such output before a patent application is filed, thereby jeopardizing our ability to seek patent protection. In addition, publications of discoveries in the scientific literature often lag behind the actual discoveries, and patent applications in the United States and other jurisdictions are typically not published until 18 months after filing, or in some cases not at all. Therefore, we cannot be certain that we or our licensors were the first to make the inventions claimed in our owned or licensed patents or pending patent applications, or were the first to file for patent protection of such inventions. To determine the priority of these inventions, we may have to participate in interference proceedings, derivation proceedings, *inter partes* review proceedings, or other post-grant proceedings declared by the USPTO that could result in substantial cost to us. The outcome of such proceedings is uncertain. No assurance can be given that other patent applications will not have priority over our patent applications. In addition, changes to the patent laws of the United States allow for various post-grant opposition proceedings, such as *inter partes* review proceedings, that have not been extensively tested, and their outcome is therefore uncertain. An unfavorable outcome could require us to cease using the related technology or to attempt to license rights to it from the prevailing party. Our business could be harmed if the prevailing party does not offer us a license on commercially reasonable terms or at all, or if a non-exclusive license is offered and our competitors gain access to the same technology. Furthermore, if third parties bring these proceedings against our patents, we could experience significant costs and management distraction.

We may become involved in lawsuits to protect or enforce our patents or other intellectual property, which could be expensive, time consuming, and unsuccessful.

Competitors may also infringe our patents or the patents of our licensing partners. In addition, our patents or the patents of our licensors may become involved in inventorship, priority, or validity disputes. To counter or defend against such claims can be expensive and time consuming. In an infringement proceeding, a court may refuse to stop the other party from using the technology at issue on the grounds that our owned and in-licensed patents do not cover the technology in question. Further in such proceedings, the defendant could counterclaim that our asserted patent covering our product is invalid or unenforceable, and the court may agree that our asserted patent is invalid or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity or unenforceability are commonplace. Grounds for a validity challenge could be an alleged failure to meet any of several statutory requirements, including lack of novelty, obviousness or non-enablement. Grounds for an unenforceability assertion could be an allegation that someone connected with the prosecution of the patent withheld relevant information from the USPTO, or made a misleading statement, during prosecution. Third parties may also raise similar claims before administrative bodies in the United States or abroad, even outside the context of litigation. Such mechanisms include re-examination, post grant review, *inter partes* review, and equivalent proceedings in foreign jurisdictions (e.g., opposition proceedings). Such proceedings could result in revocation or amendment to our patents in such a way that they no longer cover our product. The outcome following legal assertions of invalidity and unenforceability is unpredictable. With respect to the validity question, for example, we cannot be certain that there is no invalidating prior art, of which we and the patent examiner were unaware during prosecution. An adverse result in any litigation or other proceeding could put one or more of our owned or in-licensed patents at risk of being invalidated or interpreted narrowly. Such a loss of patent protection could have a material adverse impact on our business. Furthermore, because of the substantial

amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation.

Even if resolved in our favor, litigation or other legal proceedings relating to intellectual property claims may cause us to incur significant expenses and could distract our personnel from their normal responsibilities. In addition, there could be public announcements of the results of hearings, motions, or other interim proceedings or developments, and if securities analysts or investors perceive these results to be negative, it could have a substantial adverse effect on the price of our common stock. Such litigation or proceedings could substantially increase our operating losses and reduce the resources available for development activities or any future sales, marketing, or distribution activities. We may not have sufficient financial or other resources to conduct such litigation or proceedings adequately. Some of our competitors may be able to sustain the costs of such litigation or proceedings more effectively than we can because of their greater financial resources and more mature and developed intellectual property portfolios. Uncertainties resulting from the initiation and continuation of patent litigation or other proceedings could have a material adverse effect on our ability to compete in the marketplace.

If we are unable to protect the confidentiality of our trade secrets and know-how, our business and competitive position would be harmed.

We seek protection for certain aspects of our technologies, products and services through the filing of patents, registration of copyrights and use of non-disclosure agreements. In addition, we also expect to rely on trade secrets and proprietary know-how protection for our confidential and proprietary information, and we have taken security measures to protect this information. These measures, however, may not provide adequate protection for our trade secrets, know-how, or other confidential information. Among other things, we seek to protect our trade secrets, know-how, and confidential information by entering into confidentiality agreements with parties who have access to them, such as our employees, collaborators, contract manufacturers, consultants, advisors, and other third parties. We cannot guarantee that we have entered into such agreements with each party that may have or have had access to our trade secrets or proprietary technology and processes. Moreover, there can be no assurance that any confidentiality agreements that we have with our employees, consultants, or other third parties will provide meaningful protection for our trade secrets, know-how, and confidential information or will provide adequate remedies in the event of unauthorized use or disclosure of such information. Despite these efforts, any of these parties may breach the agreements and disclose our proprietary information, including our trade secrets, and we may not be able to obtain adequate remedies for such breaches. Monitoring unauthorized uses and disclosures is difficult, and we do not know whether the steps we have taken to protect our proprietary technologies will be effective. Accordingly, there also can be no assurance that our trade secrets or know-how will not otherwise become known or be independently developed by competitors.

Enforcing a claim that a party illegally disclosed or misappropriated a trade secret can be difficult, expensive, and time-consuming, and the outcome is unpredictable. In addition, trade secrets may be independently developed by others in a manner that could prevent legal recourse by us. If any of our confidential or proprietary information, such as our trade secrets, were to be disclosed or misappropriated, or if any such information was independently developed by a competitor, our competitive position would be materially and adversely harmed.

Trade secrets and know-how can be difficult to protect as trade secrets and know-how will over time be disseminated within the industry through independent development, the publication of journal articles, and the movement of personnel skilled in the art from company to company or academic to industry scientific positions. If any of our trade secrets were to be lawfully obtained or independently developed by a competitor or other third party, we would have no right to prevent such competitor from using that technology or information to compete with us, which could harm our competitive position. Because from time to time we expect to rely on third parties in the development, manufacture and distribution of our products and provision of our services, we must, at times, share trade secrets with them. We seek to protect our proprietary technology in part by entering into confidentiality agreements and, if applicable, material transfer agreements, license agreements, collaboration

agreements, supply agreements, consulting agreements or other similar agreements with our advisors, employees, collaborators, licensors, suppliers, third-party contractors, and consultants prior to beginning research or disclosing proprietary information. These agreements typically limit the rights of the third parties to use or disclose our confidential information, including our trade secrets and know-how. Despite the contractual provisions employed when working with third parties, the need to share trade secrets, know-how, and other confidential information increases the risk that such trade secrets and know-how become known by our competitors, are inadvertently incorporated into the technology of others, or are disclosed or used in violation of these agreements. Given that our proprietary position is based, in part, on our know-how and trade secrets, a competitor's discovery of our trade secrets or know-how, or other unauthorized use or disclosure would impair our competitive position and may have an adverse effect on our business and results of operations.

In addition, these agreements typically restrict the ability of our advisors, employees, collaborators, licensors, suppliers, third-party contractors, and consultants to publish data potentially relating to our trade secrets or know-how, although our agreements may contain certain limited publication rights. Despite our efforts to protect our trade secrets and know-how, our competitors may discover our trade secrets or know-how, either through breach of our agreements with third parties, independent development, or publication of information by any of our third-party collaborators. A competitor's discovery of our trade secrets or know-how would impair our competitive position and have a material adverse impact on our business.

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

Filing, prosecuting, maintaining, defending, and enforcing patents on our products, services, and technologies in all countries throughout the world would be prohibitively expensive, and our intellectual property rights in some countries outside the United States can be less extensive than those in the United States. Competitors may use our technologies in jurisdictions where we have not obtained patent protection to develop their own products and, further, may export otherwise infringing products to territories where we have patent protection or licenses but enforcement is not as strong as that in the United States. These products may compete with our products, and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing. In addition, the laws of some foreign countries do not protect proprietary rights to the same extent as the laws of the United States, and many companies have encountered significant challenges in establishing and enforcing their proprietary rights outside of the United States. These challenges can be caused by the absence or inconsistency of the application of rules and methods for the establishment and enforcement of intellectual property rights outside of the United States. In addition, the legal systems of some countries, particularly developing countries, do not favor the enforcement of patents and other intellectual property protection, especially those relating to healthcare. This could make it difficult for us to stop the infringement of our patents, if obtained, or the misappropriation of our other intellectual property rights. For example, many foreign countries, including European Union countries, India, Japan, and China, have compulsory licensing laws under which a patent owner may be compelled under specified circumstances to grant licenses to third parties. In addition, many countries limit the enforceability of patents against third parties, including government agencies or government contractors. In these countries, patents may provide limited or no benefit given that we may have limited remedies available if patents are infringed or if we are compelled to grant a license to a third party, which could materially diminish the value of those patents and limit our potential revenue opportunities. Furthermore, patent protection must ultimately be sought on a country-by-country basis, which is an expensive and time-consuming process with uncertain outcomes. Accordingly, we may choose not to seek patent protection in certain countries, and we will not have the benefit of patent protection in such countries.

Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial costs and divert our efforts and attention from other aspects of our business. Accordingly, our efforts to protect our intellectual property rights in such countries may be inadequate. In addition, changes in the law and legal decisions by courts in the United States and foreign countries may affect our ability to obtain adequate protection for our products, services and other technologies and the enforcement of intellectual property. Any of the foregoing could have a material adverse effect on our competitive position, business, financial condition, results of operations, and prospects.

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

The USPTO and various foreign governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other provisions during the patent application and prosecution process. Periodic maintenance fees, renewal fees, annuity fees, and various other governmental fees on patents and/or applications will be due to be paid to the USPTO and various other governmental patent agencies outside of the United States in several stages over the lifetime of the patents and/or applications. We employ reputable professionals and rely on such third parties to help us comply with these requirements and effect payment of these fees with respect to the patents and patent applications that we own. Noncompliance events that could result in abandonment or lapse of a patent or patent application include failure to respond to official communications within prescribed time limits, non-payment of fees and failure to properly legalize and submit formal documents. In many cases, an inadvertent lapse can be cured by payment of a late fee or by other means in accordance with the applicable rules. However, there are situations in which noncompliance can result in abandonment or lapse of a patent or patent application, resulting in loss of patent rights in the relevant jurisdiction. In such an event, competitors might be able to enter the market earlier than would otherwise have been the case, which could have a material adverse effect on our competitive position, business, financial condition, results of operations, and prospects.

Third parties may assert that our employees or consultants have wrongfully used or disclosed confidential information or misappropriated trade secrets.

We employ individuals who were previously employed or otherwise engaged with universities or genetic testing, diagnostic or other healthcare companies, including our competitors or potential competitors.

Although we have policies to ensure that our employees and consultants do not use the proprietary information or know-how of others in their work for us, we may be subject to claims that we or our employees or consultants have inadvertently or otherwise used or disclosed intellectual property, including trade secrets or other proprietary information, of a former employer or other third parties. Further, we may be subject to ownership disputes in the future arising, for example, from conflicting obligations of consultants or others who are involved in developing our intellectual property. Litigation may be necessary to defend against these claims. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees. Such claims could have a material adverse effect on our business, financial condition, results of operations, and prospects.

In addition, while it is our policy to require our employees and contractors who may be involved in the conception or development of intellectual property to execute agreements assigning such intellectual property to us, we may be unsuccessful in executing such an agreement with each party who, in fact, conceives or develops intellectual property that we regard as our own. The assignment of intellectual property rights may not be self-executing, or the assignment agreements may be breached, and we may be forced to bring claims against third parties, or defend claims that they may bring against us, to determine the ownership of what we regard as our intellectual property. Such claims could have a material adverse effect on our business, financial condition, results of operations, and prospects.

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

A portion of the products or technologies licensed, developed, and/or distributed by us incorporate so-called "open source" software and we may incorporate open source software into other products in the future. Such open source software is generally licensed by its authors or other third parties under open source licenses. Some

open source licenses contain requirements that we disclose source code for modifications we make to the open source software and that we license such modifications to third parties at no cost. In some circumstances, distribution of our software in connection with open source software could require that we disclose and license some or all of our proprietary code in that software, as well as distribute our products or provide our services that use particular open source software at no cost to the user. We monitor our use of open source software in an effort to avoid uses in a manner that would require us to disclose or grant licenses under our proprietary source code; however, there can be no assurance that such efforts will be successful. Open source license terms are often ambiguous and such use could inadvertently occur. There is little legal precedent governing the interpretation of many of the terms of these licenses, and the potential impact of these terms on our business may result in unanticipated obligations regarding our products and technologies. Companies that incorporate open source software into their products have, in the past, faced claims seeking enforcement of open source license provisions and claims asserting ownership of open source software incorporated into their product. If an author or other third party that distributes such open source software were to allege that we had not complied with the conditions of an open source license, we could incur significant legal costs defending ourselves against such allegations. In the event such claims were successful, we could be subject to significant damages or be enjoined from the distribution of our products. In addition, if we combine our proprietary software with open source software in certain ways, under some open source licenses, we could be required to release the source code of our proprietary software, which could substantially help our competitors develop products that are similar to or better than ours and otherwise adversely affect our business. These risks could be difficult to eliminate or manage, and, if not addressed, could have a material adverse effect on our business, financial condition, and results of operations.

If we fail to comply with our obligations under license or technology agreements with third parties, we may be required to pay damages and we could lose license rights that are critical to our business.

We license certain intellectual property that is important to our business, and in the future we may enter into additional agreements that provide us with licenses to valuable intellectual property or technology. For example, our agreements with third parties, such as Illumina, include certain non-exclusive license rights that are essential to the operation of our business as it is currently conducted. If we fail to comply with any of the obligations under our license agreements, we may be required to pay damages and the licensor may have the right to terminate the license. Termination by the licensor would cause us to lose valuable rights, and could prevent us from selling our products and services, or inhibit our ability to commercialize future products and services. Our business would suffer if any current or future licenses terminate, if the licensors fail to abide by the terms of the license, if the licensors fail to enforce licensed patents against infringing third parties, if the licensed patents or other rights are found to be invalid or unenforceable, or if we are unable to enter into necessary licenses on acceptable terms. In addition, our rights to certain technologies, including those of Illumina, are licensed to us on a non-exclusive basis. The owners of these non-exclusively licensed technologies are therefore free to license them to third parties, including our competitors, on terms that may be superior to those offered to us, which could place us at a competitive disadvantage. Moreover, our licensors may own or control intellectual property that has not been licensed to us and, as a result, we may be subject to claims, regardless of their merit, that we are infringing or otherwise violating the licensor's rights.

Any collaboration arrangements that we may enter into in the future may not be successful, which could adversely affect our ability to develop and commercialize our products.

Any future collaborations that we enter into may not be successful. The success of our collaboration arrangements will depend heavily on the efforts and activities of our collaborators. Collaborations are subject to numerous risks, which may include that:

- collaborators have significant discretion in determining the efforts and resources that they will apply to collaborations;
- collaborators may not pursue development and commercialization of our products or may elect not to continue or renew development or commercialization programs based on trial or test results, changes in

their strategic focus due to the acquisition of competitive products, availability of funding, or other external factors, such as a business combination that diverts resources or creates competing priorities;

- collaborators could independently develop, or develop with third parties, products that compete directly or indirectly with our products;
- collaborators with marketing, manufacturing, and distribution rights to one or more products may not commit sufficient resources to or otherwise not perform satisfactorily in carrying out these activities;
- we could grant exclusive rights to our collaborators that would prevent us from collaborating with others;
- collaborators may not properly maintain or defend our intellectual property rights or may use our intellectual property or proprietary information in a way that gives rise to actual or threatened litigation that could jeopardize or invalidate our intellectual property or proprietary information or expose us to potential liability;
- disputes may arise between us and a collaborator that causes the delay or termination of the research, development, or commercialization of our current or future products or that results in costly litigation or arbitration that diverts management attention and resources;
- collaborations may be terminated, and, if terminated, may result in a need for additional capital to pursue further development or commercialization of the applicable current or future products;
- collaborators may own or co-own intellectual property covering our products that results from our collaborating with them, and in such cases, we would not have the exclusive right to develop or commercialize such intellectual property; and
- collaborators' sales and marketing activities or other operations may not be in compliance with applicable laws resulting in civil or criminal proceedings.

If we are unable to successfully obtain rights to required third-party intellectual property rights or maintain the existing intellectual property rights we have, we may have to abandon development of that program and our business and financial condition could suffer.

We may be subject to claims challenging the inventorship of our patents and other intellectual property.

We or our licensors may be subject to claims that former employees, collaborators, or other third parties have an interest in our patents, trade secrets, or other intellectual property as an inventor or co-inventor. For example, we or our licensors may have inventorship disputes arise from conflicting obligations of employees, consultants, or others who are involved in developing our products, services, or technologies. Litigation may be necessary to defend against these and other claims challenging inventorship or our licensors' ownership of our owned or in-licensed patents, trade secrets, or other intellectual property. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights, such as exclusive ownership of, or right to use, intellectual property that is important to our products, services, or technologies. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees. Any of the foregoing could have a material adverse effect on our business, financial condition, results of operations, and prospects.

If our trademarks and trade names are not adequately protected, then we may not be able to build name recognition in our markets of interest and our business may be adversely affected.

Our trademarks or trade names may be challenged, infringed, circumvented, or declared generic or determined to be infringing on other marks. We may not be able to protect our rights to these trademarks and trade names or may be forced to stop using these names, which we need for name recognition by potential partners or customers in our markets of interest. During trademark registration proceedings, we may receive

rejections. Although we would be given an opportunity to respond to those rejections, we may be unable to overcome such rejections. In addition, in the USPTO 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. If we are unable to establish brand name recognition based on our trademarks and trade names, we may not be able to compete effectively and our business may be adversely affected.

Risks Related to Being a Public Company

The requirements of being a public company may strain our resources, result in litigation and divert management's attention.

As a public company, we will be subject to the reporting requirements of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), the Sarbanes-Oxley Act of 2002, as amended (the "Sarbanes-Oxley Act"), the Dodd-Frank Wall Street Reform and Consumer Protection Act, the listing requirements of the stock exchange on which we will list, and other applicable securities rules and regulations. Complying with these rules and regulations has increased and will increase our legal and financial compliance costs, make some activities more difficult, time-consuming, or costly and increase demand on our systems and resources, particularly after we are no longer an "emerging growth company" as defined in the Jumpstart our Business Startups Act of 2012 (the "JOBS Act"). The Exchange Act requires, among other things, that we file annual, quarterly, and current reports with respect to our business and operating results. The Sarbanes-Oxley Act requires, among other things, that we maintain effective disclosure controls and procedures and internal control over financial reporting. We are required to disclose changes made in our internal control and procedures on a quarterly basis. In order to maintain and, if required, improve our disclosure controls and procedures and internal control over financial reporting to meet this standard, significant resources and management oversight may be required. As a result, management's attention may be diverted from other business concerns, which could adversely affect our business and operating results. We will need to hire additional employees or engage outside consultants to comply with these requirements, which will increase our costs and expenses.

In addition, changing laws, regulations, and standards relating to corporate governance and public disclosure are creating uncertainty for public companies, increasing legal and financial compliance costs and making some activities more time-consuming. These laws, regulations, and standards are subject to varying interpretations, in many cases due to their lack of specificity, and, as a result, their application in practice may evolve over time as new guidance is provided by regulatory and governing bodies. This could result in continuing uncertainty regarding compliance matters and higher costs necessitated by ongoing revisions to disclosure and governance practices. We intend to invest resources to comply with evolving laws, regulations, and standards, and this investment will result in increased general and administrative expenses and a diversion of management's time and attention from revenue-generating activities to compliance activities. If our efforts to comply with new laws, regulations and standards differ from the activities intended by regulatory or governing bodies due to ambiguities related to their application and practice, regulatory authorities may initiate legal proceedings against us and our business may be adversely affected. By disclosing information in this prospectus and in filings required of a public company, our business and financial condition will become more visible, which we believe may result in threatened or actual litigation, including by competitors and other third parties. If those claims are successful, our business could be seriously harmed. Even if the claims do not result in litigation or are resolved in our favor, the time and resources needed to resolve them could divert our management's resources and seriously harm our business.

We also expect that being a public company and these new rules and regulations will make it more expensive for us to obtain director and officer liability insurance and, in the future, we may be required to accept reduced coverage or incur substantially higher costs to obtain coverage. These factors could also make it more difficult for us to attract and retain qualified members of our board of directors, particularly to serve on our audit committee and compensation committee, and qualified executive officers.

In addition, as a result of our disclosure obligations as a public company, we will have reduced strategic flexibility and will be under pressure to focus on short-term results, which may materially and adversely affect our ability to achieve long-term profitability.

We are an emerging growth company, and any decision on our part to comply only with certain reduced reporting and disclosure requirements applicable to emerging growth companies could make our common stock less attractive to investors.

We are an "emerging growth company," as defined in the JOBS Act, and, for as long as we continue to be an emerging growth company, we may choose to take advantage of exemptions from various reporting requirements applicable to other public companies but not to emerging growth companies, including:

- not being required to have our independent registered public accounting firm audit our internal control over financial reporting under Section 404 of the Sarbanes-Oxley Act;
- reduced disclosure obligations regarding executive compensation in our periodic reports and annual report on Form 10-K; and
- exemptions from the requirements of holding non-binding advisory votes on executive compensation and stockholder approval of any golden parachute payments not previously approved.

We could be an emerging growth company for up to five years following the closing of this offering. Our status as an emerging growth company will end as soon as any of the following takes place:

- the last day of the fiscal year in which we have more than $1.07 billion in annual revenue;
- the date we qualify as a "large accelerated filer," with at least $700 million of equity securities held by non-affiliates;
- the date on which we have issued, in any three-year period, more than $1.0 billion in non-convertible debt securities; or
- the last day of the fiscal year ending after the fifth anniversary of the closing of this offering.

We cannot predict if investors will find our common stock less attractive if we choose to rely on any of the exemptions afforded emerging growth companies. If some investors find our common stock less attractive because we rely on any of these exemptions, there may be a less active trading market for our common stock and the market price of our common stock may be more volatile.

Under the JOBS Act, emerging growth companies can also delay adopting new or revised accounting standards until such time as those standards apply to private companies. We have irrevocably elected not to avail ourselves of this accommodation and, therefore, we will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

Material weaknesses in our internal control over financial reporting may cause us to fail to timely and accurately report our financial results or result in a material misstatement of our financial statements.

Management evaluates our internal control systems, processes, and procedures for compliance with the requirements of a smaller reporting company under Section 404 of the Sarbanes-Oxley Act of 2002 ("Section 404"). This evaluation includes disclosure of any material weaknesses identified by our management in our internal control over financial reporting. A "material weakness" is a deficiency, or a combination of deficiencies, in internal control over financial reporting such that there is a reasonable possibility that a material misstatement of our annual or interim financial statements will not be prevented or detected on a timely basis.

In connection with preparation of our financial statements for the years ended December 31, 2017 and 2018, management identified a material weakness in our internal controls due to a lack of sufficient full-time

accounting staff with requisite experience and deep technical accounting knowledge to (i) identify and resolve complex accounting issues under generally accepted accounting principles in the United States ("GAAP") and (ii) allow for appropriate segregation of duties. The identified material weakness could result in misstatements to our consolidated financial statements that would be material and would not be prevented or detected on a timely basis.

We are evaluating and implementing additional procedures to remediate this material weakness, however, we cannot assure you that these or other measures will fully remediate the material weakness in a timely manner or prevent future material weaknesses from occurring. As part of our remediation plan to address the material weakness identified above, we hired a new Chief Financial Officer in March 2019 and are actively working to hire additional accounting employees with the specific technical accounting and financial reporting experience necessary for a public company. We will continue to assess the adequacy of our accounting personnel and resources, and will add additional personnel, as well as adjust our resources, as necessary, commensurate with any increase in the size and complexity of our business.

If we identify future material weaknesses in our internal controls over financial reporting or fail to meet the demands that will be placed upon us as a public company, including the requirements of the Sarbanes-Oxley Act, we may be unable to accurately report our financial results or report them within the timeframes required by law or stock exchange regulations. Failure to comply with Section 404 could also potentially subject us to sanctions or investigations by the U.S. Securities and Exchange Commission (the "SEC") or other regulatory authorities. If additional material weaknesses exist or are discovered in the future, and we are unable to remediate any such material weakness, our reputation, financial condition, and operating results could suffer.

Our disclosure controls and procedures may not prevent or detect all errors or acts of fraud.

Upon closing of this offering, we will have implemented disclosure controls and procedures designed to provide reasonable assurance that information we must disclose in reports we file or submit under the Exchange Act is accumulated and communicated to management and recorded, processed, summarized, and reported within the time periods specified in the rules and forms of the SEC. However, any disclosure controls and procedures, no matter how well-conceived and operated, can provide only reasonable, not absolute, assurance that the objectives of the control system are met.

These inherent limitations include the realities that judgments in decision-making can be faulty and that breakdowns can occur because of simple errors or mistakes. Additionally, controls can be circumvented by the individual acts of some persons, by collusion of two or more people or by an unauthorized override of the controls. As a result, because of these inherent limitations in our control system, misstatements or omissions due to error or fraud may occur and may not be detected, which could result in failures to file required reports in a timely manner and filing reports containing incorrect information. Any of these outcomes could result in SEC enforcement actions, monetary fines or other penalties, damage to our reputation, and harm to our financial condition.

Risks Related to This Offering and Our Common Stock

An active trading market for our common stock may never develop or be sustained.

Prior to this offering, there has been no public market for our common stock. We have been approved to list our common stock on The Nasdaq Global Market under the symbol "PSNL." However, we cannot assure you that an active trading market for our common stock will develop on that exchange or elsewhere or, if developed, that any market will be sustained. Accordingly, we cannot assure you of the likelihood that an active trading market for our common stock will develop or be maintained, the liquidity of any trading market, your ability to sell your shares of our common stock when desired, or the prices that you may obtain for your shares. Further, an inactive market may also impair our ability to raise capital by selling our common stock and may impair our ability to

enter into strategic partnerships or acquire businesses, products, or technologies using our common stock as consideration.

The market price of our common stock may be volatile or may decline steeply or suddenly regardless of our operating performance and we may not be able to meet investor or analyst expectations. You may not be able to resell your shares at or above the initial public offering price and may lose all or part of your investment.

The initial public offering price for our common stock has been determined through negotiations between the underwriters and us, and may vary from the market price of our common stock following this offering. If you purchase shares of our common stock in this offering, you may not be able to resell those shares at or above the initial public offering price. We cannot assure you that the market price following this offering will equal or exceed prices in privately negotiated transactions of our shares that have occurred from time to time before this offering. The market price of our common stock may fluctuate or decline significantly in response to numerous factors, many of which are beyond our control, including:

- actual or anticipated fluctuations in our operating results;
- failure to meet or exceed financial estimates and projections of the investment community or that we provide to the public;
- issuance of new or updated research reports by securities analysts or changed recommendations for our stock;
- competition from existing tests or new tests that may emerge;
- announcements by us or our competitors of significant acquisitions, strategic partnerships, joint ventures, collaborations, capital commitments, or by or pertaining to our customers, particularly the VA MVP;
- the timing and amount of our investments in the growth of our business;
- actual or anticipated changes in regulatory oversight of our business or issues we may face with regulators;
- additions or departures of key management or other personnel;
- inability to obtain additional funding;
- sales of our common stock by us or our stockholders in the future;
- disputes or other developments related to our intellectual property or other matters, including litigation; and
- general economic, industry, and market conditions, including factors unrelated to our operating performance or the operating performance of our competitors.

In addition, the stock market in general, and the market for life sciences companies in particular, has experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of those companies. Broad market and industry factors may seriously affect the market price of our common stock, regardless of our actual operating performance. These fluctuations may be even more pronounced in the trading market for our stock shortly following this offering. In addition, in the past, following periods of volatility in the overall market and the market price of a particular company's securities, securities class action litigation has often been instituted against these companies. This litigation, if instituted against us, could result in substantial costs and a diversion of our management's attention and resources.

Moreover, because of these fluctuations, comparing our operating results on a period-to-period basis may not be meaningful. You should not rely on our past results as an indication of our future performance. This

variability and unpredictability could also result in our failing to meet the expectations of industry or financial analysts or investors for any period. If our revenues or operating results fall below the expectations of analysts or investors or below any forecasts we may provide to the market, or if the forecasts we provide to the market are below the expectations of analysts or investors, the price of our common stock could decline substantially. Such a stock price decline could occur even when we have met any previously publicly stated revenues or earnings forecasts that we may provide.

Our quarterly results may fluctuate significantly, which could adversely impact the value of our common stock.

Our quarterly results of operations, including our revenue, gross margin, profitability, and cash flows, may vary significantly in the future, and period-to-period comparisons of our operating results may not be meaningful. Accordingly, our quarterly results should not be relied upon as an indication of future performance. Our quarterly financial results may fluctuate as a result of a variety of factors, many of which are outside of our control. For example, the VA and other large customers are not obliged to deliver tissue samples to us at any particular time or at all. The rate at which we receive tissue samples can vary dramatically from quarter to quarter, and is difficult or impossible for us to accurately forecast. Our receipt and processing of tissue samples from our customers leads to our recognition of revenue, and as such the variable rates of delivery of customer samples will lead to variations in our revenues from quarter to quarter. Fluctuations in quarterly results may adversely impact the value of our common stock. Factors that may cause fluctuations in our quarterly financial results include, without limitation, those listed elsewhere in this “Risk Factors” section. We also may face competitive pricing pressures, and we may not be able to maintain our pricing in the future, which would adversely affect our operating results.

Insiders may exercise significant control over our company and will be able to influence corporate matters.

Our directors, executive officers, and 5% or greater stockholders and their affiliates beneficially owned, in the aggregate, approximately 76.0% of our outstanding capital stock as of March 31, 2019. Upon the closing of this offering, this same group will hold approximately 56.9% of our outstanding capital stock, without giving effect to any purchases that certain of these holders may make through our directed share program. As a result, these stockholders will be able to exercise significant influence over all matters submitted to our stockholders for approval, including the election of directors and approval of significant corporate transactions, such as a merger or sale of our company or its assets. This concentration of ownership may have the effect of delaying or preventing a third party from acquiring control of our company and could adversely affect the market price of our common stock, and may not be in the best interests of our other stockholders.

Future sales of shares by existing stockholders, or the perception that such sales could occur, could cause our stock price to decline.

If our existing stockholders sell, or indicate an intent to sell, substantial amounts of our common stock in the public market after the 180-day contractual lock-up and other legal restrictions on resale discussed in this prospectus lapse, the trading price of our common stock could decline significantly and could decline below the initial public offering price. Based on 21,829,701 shares outstanding as of March 31, 2019 (and assuming the exercise in full of a warrant exercisable for 188,643 shares of common stock), upon the closing of this offering, we will have 29,751,201 outstanding shares of common stock. Of these shares, the 7,921,500 shares of common stock sold in this offering, plus any shares sold pursuant to the underwriters’ option to purchase additional shares, will be immediately freely tradable, without restriction, in the public market, unless they are purchased in this offering by our affiliates, as that term is defined in Rule 144 under the Securities Act of 1933, as amended (the “Securities Act”) or if they are purchased in our directed share program. Morgan Stanley & Co. LLC, BofA Securities, Inc., and Cowen and Company, LLC, however, may, in their discretion, permit our officers, directors, and other stockholders who have entered to lock-up agreements in connection with this offering to sell shares prior to the expiration of the lock-up agreements.

After the lock-up agreements pertaining to this offering expire, substantially all of such shares will be eligible for sale in the public market. In addition, upon issuance, the 4,381,884 shares of common stock subject to outstanding options under our stock option plans as March 31, 2019 will become eligible for sale in the public market in the future, subject to certain legal and contractual limitations. Moreover, 180 days after the closing of this offering, holders of up to an aggregate of 18,790,983 shares of our common stock (including an aggregate of 127,598 shares issuable upon the exercise of warrants that were outstanding as of March 31, 2019) will have the right to require us to register these shares under the Securities Act pursuant to an investors' rights agreement. If our existing stockholders sell substantial amounts of our common stock in the public market, or if the public perceives that such sales could occur, this could have an adverse effect on the market price of our common stock.

We also intend to register shares of our common stock that we may issue under our equity incentive plans, totaling 4,745,324 shares subject to outstanding options and 7,440,524 additional shares reserved for issuance as of the closing of this offering. Once we register these shares, they will be freely tradable in the public market upon issuance, subject to volume and manner of sale limitations applicable to affiliates and other legal and contractual limitations.

We have broad discretion in how we may use the net proceeds from this offering, and we may not use them effectively.

We cannot specify with any certainty the particular uses of the net proceeds that we will receive from this offering. Our management will have broad discretion in applying the net proceeds we receive from this offering for any of the purposes described in section titled "Use of Proceeds." You will not have the opportunity, as part of your investment decision, to assess whether we are using the net proceeds appropriately, and you will be relying on the judgment of our management regarding the use of these net proceeds. Our management may not apply the net proceeds in ways that increase the value of your investment. If our management fails to use these funds effectively, our business could be seriously harmed. Pending their use, the net proceeds from this offering may be invested in a way that does not produce income or that loses value.

We do not currently intend to pay dividends on our common stock and, consequently, your ability to achieve a return on your investment will depend on appreciation of the value of our common stock.

We have never declared or paid cash dividends on our capital stock. We currently intend to retain any future earnings to finance the operation and expansion of our business, and we do not expect to pay any cash dividends on our common stock in the foreseeable future. In addition, our ability to pay cash dividends on our capital stock is limited by our credit agreement and may be prohibited or limited by the terms of any future debt financing arrangement. As a result, any investment returns on our common stock will depend upon increases in the value for our common stock, which are not certain.

Our ability to use net operating losses to offset future taxable income may be subject to limitations.

As of December 31, 2018, we had federal and state net operating loss carryforwards of approximately $87 million and approximately $48.6 million, respectively. Certain of our federal and state net operating loss carryforwards will begin to expire, if not utilized, beginning in 2031. These net operating loss carryforwards could expire unused and be unavailable to offset future income tax liabilities. Under the Tax Cuts and Jobs Act, federal net operating losses incurred in 2018 and in future years may be carried forward indefinitely, but the deductibility of such federal net operating losses is limited. It is uncertain if and to what extent various states will conform to the Tax Cuts and Jobs Act. In addition, under Section 382 of the Code, and corresponding provisions of state law, if a corporation undergoes an "ownership change," which is generally defined as a greater than 50% change, by value, in its equity ownership over a three-year period, the corporation's ability to use its pre-change net operating loss carryforwards and other pre-change tax attributes (including certain tax credits) to offset its post-change income or taxes may be limited. It is possible that we have experienced an ownership change or that we will experience one in connection with this offering. We may experience ownership changes in the future as a

result of subsequent shifts in our stock ownership, some of which may be outside of our control. If an ownership change occurs and our ability to use our net operating loss carryforwards is materially limited, it would harm our future operating results by effectively increasing our future tax obligations.

Purchasers in this offering will experience immediate and substantial dilution in the book value of their investment.

The initial public offering price of our common stock is substantially higher than the net tangible book value per share of our common stock as of March 31, 2019. Therefore, if you purchase our common stock in this offering, you will incur immediate dilution of $13.58 per share, based on the initial public offering price of $17.00 per share. This dilution is due to the substantially lower price paid by our investors who purchased shares prior to this offering as compared to the price offered to the public in this offering, and any previous exercise of stock options granted to our service providers. In addition, as of March 31, 2019, options to purchase 4,381,884 shares of our common stock with a weighted-average exercise price of approximately $3.62 per share were outstanding. The exercise of any of these options would result in additional dilution. As a result of the dilution to investors purchasing shares in this offering, investors may receive less than the purchase price paid in this offering, if anything, in the event of our liquidation. In addition, new investors who purchase shares in this offering will contribute approximately 59.8% of the total amount of equity capital raised by us through the date of this offering, but will only own approximately 26.6% of the outstanding equity capital. For a detailed description of the dilution that you will experience immediately after this offering, see the section titled “Dilution.”

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

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

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

The trading market for our common stock will depend in part on the research and reports that equity research analysts publish about us and our business. We do not control these analysts or the content and opinions included in their reports. Securities analysts may elect not to provide research coverage of our company after the closing of this offering, and such lack of research coverage may adversely affect the market price of our common stock. The price of our common stock could also decline if one or more equity research analysts downgrade our common stock or issue other unfavorable commentary or cease publishing reports about us or our business. If one or more equity research analysts cease coverage of our company, we could lose visibility in the market, which in turn could cause our stock price to decline.

Holders of our common stock could be adversely affected if we issue preferred stock.

Pursuant to our amended and restated certificate of incorporation, our board of directors is authorized to issue up to 10,000,000 shares of preferred stock without any action on the part of our stockholders. Our board of directors will also have the power, without stockholder approval, to set the terms of any series of preferred stock

that may be issued, including voting rights, dividend rights, preferences over our common stock with respect to dividends or in the event of a dissolution, liquidation, or winding up, and other terms. In the event that we issue preferred stock in the future that has preferences over our common stock with respect to payment of dividends or upon our liquidation, dissolution, or winding up, or if we issue preferred stock that is convertible into our common stock at greater than a one-to-one ratio, the voting and other rights of the holders of our common stock or the market price of our common stock could be adversely affected.

Delaware law and provisions in our amended and restated certificate of incorporation and amended and restated bylaws that will be in effect on the closing of this offering could make a merger, tender offer, or proxy contest difficult, thereby depressing the trading price of our common stock.

Our amended and restated certificate of incorporation and amended and restated bylaws that will be in effect on the closing of this offering contain provisions that could depress the trading price of our common stock by acting to discourage, delay or prevent a change of control of our company or changes in our management that the stockholders of our company may deem advantageous. These provisions include the following:

- establish a classified board of directors so that not all members of our board of directors are elected at one time;
- authorize the issuance of "blank check" preferred stock that our board of directors could use to implement a stockholder rights plan;
- permit the board of directors to establish the number of directors and fill any vacancies and newly-created directorships;
- provide that directors may only be removed for cause;
- require super-majority voting to amend some provisions in our certificate of incorporation and bylaws;
- eliminate the ability of our stockholders to call special meetings of stockholders;
- prohibit stockholder action by written consent, which requires all stockholder actions to be taken at a meeting of our stockholders;
- provide that the board of directors is expressly authorized to make, alter, or repeal our bylaws;
- restrict the forum for certain litigation against us to Delaware; and
- establish advance notice requirements for nominations for election to our board of directors or for proposing matters that can be acted upon by stockholders at annual stockholder meetings.

Any provision of our amended and restated certificate of incorporation or amended and restated bylaws, each of which will be in effect on the closing of this offering or Delaware law that has the effect of delaying or deterring a change in control could limit the opportunity for our stockholders to receive a premium for their shares of our common stock, and could also affect the price that some investors are willing to pay for our common stock. For information regarding these and other provisions, see the section titled "Description of Capital Stock—Anti-Takeover Effects of Delaware Law and Our Certificate of Incorporation and Bylaws."

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

Our amended and restated certificate of incorporation that will be in effect on the closing of this offering will provide that the Court of Chancery of the State of Delaware is the exclusive forum for the following types of actions or proceedings under Delaware statutory or common law:

- any derivative action or proceeding brought on our behalf;

- any action asserting a breach of fiduciary duty;
- any action asserting a claim against us arising under the Delaware General Corporation Law, our amended and restated certificate of incorporation, or our amended and restated bylaws; and
- any action asserting a claim against us governed by the internal affairs doctrine.

This provision would not apply to suits brought to enforce a duty or liability created by the Exchange Act or any other claim for which the U.S. federal courts have exclusive jurisdiction.

Our amended and restated certificate of incorporation that will be in effect on the closing of this offering will further provide that the federal district courts of the United States will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act, subject to and contingent upon a final adjudication in the State of Delaware of the enforceability of such exclusive forum provision.

These exclusive-forum provisions may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers, or other employees, which may discourage lawsuits against us and our directors, officers, and other employees. If a court were to find either exclusive-forum provision in our amended and restated certificate of incorporation that will be in effect on the closing of this offering to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving the dispute in other jurisdictions, which could seriously harm our business. For example, the Court of Chancery of the State of Delaware recently determined that a provision stating that U.S. federal district courts are the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act is not enforceable. However, this decision may be reviewed and ultimately overturned by the Delaware Supreme Court.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus contains forward-looking statements about us and our industry that involve substantial risks and uncertainties. All statements other than statements of historical facts contained in this prospectus, including statements regarding our future results of operations, financial condition, business strategy and plans, and objectives of management for future operations, including our statements regarding the benefits and timing of the roll-out of new technology, are forward-looking statements. In some cases, you can identify forward-looking statements because they contain words such as “anticipate,” “believe,” “contemplate,” “continue,” “could,” “estimate,” “expect,” “intend,” “may,” “plan,” “potential,” “predict,” “project,” “should,” “target,” “will,” or “would,” or the negative of these words or other similar terms or expressions. Forward-looking statements in this prospectus include, but are not limited to, statements about:

- the evolution of cancer therapies and market adoption of our services;
- estimates of our total addressable market, future revenue, expenses, capital requirements, and our needs for additional financing;
- our ability to compete effectively with existing competitors and new market entrants;
- our ability to scale our infrastructure;
- our ability to manage and grow our business by expanding our sales to existing customers or introducing our products to new customers;
- expectations regarding our relationship with the VA MVP;
- our ability to establish and maintain intellectual property protection for our products or avoid claims of infringement;
- potential effects of extensive government regulation;
- our ability to hire and retain key personnel;
- our ability to obtain additional financing in this or future offerings;
- the volatility of the trading price of our common stock;
- our belief that FDA approval of personalized cancer therapies may drive benefits to our business;
- our expectation regarding the time during which we will be an emerging growth company under the JOBS Act; and
- our expectations regarding uses of proceeds from this offering.

You should not rely on forward-looking statements as predictions of future events. We have based the forward-looking statements contained in this prospectus primarily on our current expectations and projections about future events and trends that we believe may affect our business, financial condition, and operating results. The outcome of the events described in these forward-looking statements is subject to risks, uncertainties, and other factors described in the section titled “Risk Factors” and elsewhere in this prospectus. Moreover, we operate in a very competitive and rapidly changing environment. New risks and uncertainties emerge from time to time, and it is not possible for us to predict all risks and uncertainties that could have an impact on the forward-looking statements contained in this prospectus. The results, events, and circumstances reflected in the forward-looking statements may not be achieved or occur, and actual results, events, or circumstances could differ materially from those described in the forward-looking statements.

In addition, statements that “we believe” and similar statements reflect our beliefs and opinions on the relevant subject. These statements are based on information available to us as of the date of this prospectus. While we believe that information provides a reasonable basis for these statements, that information may be limited or incomplete. Our statements should not be read to indicate that we have conducted an exhaustive inquiry into, or review of, all relevant information. These statements are inherently uncertain, and investors are cautioned not to unduly rely on these statements.

The forward-looking statements made in this prospectus relate only to events as of the date on which the statements are made. We undertake no obligation to update any forward-looking statements made in this prospectus to reflect events or circumstances after the date of this prospectus or to reflect new information or the occurrence of unanticipated events, except as required by law. We may not actually achieve the plans, intentions, or expectations disclosed in our forward-looking statements, and you should not place undue reliance on our forward-looking statements. Our forward-looking statements do not reflect the potential impact of any future acquisitions, mergers, dispositions, joint ventures, or investments.

MARKET, INDUSTRY, AND OTHER DATA

This prospectus contains estimates and information concerning our industry and our business, including estimated market size, projected growth rates of the markets in which we participate, and the prevalence of certain medical conditions. Unless otherwise expressly stated, we obtained this industry, business, market, medical, and other information from reports, research surveys, studies, and similar data prepared by third parties, industry, medical, and general publications, government data, and similar sources.

This information involves a number of assumptions and limitations, and you are cautioned not to give undue weight to these estimates. We have not independently verified any third-party information and cannot assure you of its accuracy or completeness. Although we are responsible for all of the disclosure contained in this prospectus and we believe the market position, market opportunity, market size, and medical information included in this prospectus is reliable, such information is inherently imprecise. In addition, projections, assumptions, and estimates of our future performance and the future performance of the industry in which we operate are necessarily subject to a high degree of uncertainty and risk due to a variety of factors, including those described in the section titled “Risk Factors.” These and other factors could cause results to differ materially from those expressed in these publications and reports.

Certain information in the text of this prospectus is contained in independent industry publications. The source of these independent industry publications is provided below:

- U.S. National Library of Medicine, *ClinicalTrials.gov*, January 2019.
- Public Health Faculty Publications, *SEER Cancer Statistics Review*, 1975-2015.
- American Cancer Society, *Cancer Facts and Figures 2019*, 2019.
- American Cancer Society, *Cancer Facts and Figures 2018*, 2018.
- BIO Industry Analysis, *Clinical Development Success Rates 2006-2015*, June 2016.
- European Journal of Cancer, *Cancer incidence and mortality patterns in Europe: Estimates for 40 countries and 25 major cancers in 2018*, August, 9 2018.
- World Health Organization, Latest global cancer data: *Cancer burden rises to 18.1 million new cases and 9.6 million cancer deaths in 2018*, September 12, 2018.
- World Health Organization, *World’s health ministers renew commitment to cancer prevention and control*, 2017.

We use multiple sources and assumptions to estimate the total addressable market for tissue and liquid biopsy testing in clinical trials for immunotherapy, targeted cancer therapy, and personalized cancer therapy. Our estimates of the number of patients and clinical trials are based on data from the U.S. National Library of Medicine, *ClinicalTrials.gov*, January 2019. We assume that patients in such clinical trials will receive one tumor biopsy test and three liquid biopsy tests over the course of a clinical trial, and the cost of tumor and liquid biopsy tests will be $5,000 and $7,000 on average, respectively.

We also use multiple sources and assumptions to estimate the total addressable market for tissue and liquid biopsy testing in personalized cancer therapy. Our estimate of the number of cancer patients that are projected to be diagnosed with late-stage disease in 2019 is based on a combination of data derived from Public Health Faculty Publications, *SEER Cancer Statistics Review*, 1975-2015 (only data relating to cancer cases diagnosed—and the respective stage of disease upon diagnosis—from 2008 to 2014 was used for our purposes), American Cancer Society, *Cancer Facts and Figures 2018*, 2018, American Cancer Society, *Cancer Facts and Figures 2019*, 2019, and a review article from the European Journal of Cancer, *Cancer incidence and mortality patterns in Europe: Estimates for 40 countries and 25 major cancers in 2018*, August 9, 2018. We assume that personalized cancer therapy patients will receive one tumor biopsy test and three liquid biopsy tests over the course of a clinical trial or treatment, with the average cost per test being the same as is outlined above in the United States and $3,000 and $4,200 on average per test, respectively, in the European Union.

We also use multiple sources and assumptions to estimate the total addressable market for oncology clinical diagnostic testing for advanced cancer therapies. Our estimate of the number of cancer patients that are projected to be diagnosed in 2019 is based on a combination of data derived from the American Cancer Society, *Cancer Facts and Figures 2018*, 2018, American Cancer Society, *Cancer Facts and Figures 2019*, 2019, and a review article from the European Journal of Cancer, *Cancer incidence and mortality patterns in Europe: Estimates for 40 countries and 25 major cancers in 2018*, August 9, 2018. We assume that pre-diagnosis cancer patients will receive one oncology clinical diagnostic test to inform their treatment strategy or to identify clinical trial enrollment opportunities, and the cost per test will be $3,000 on average, which we believe is in line with current cancer panels.

Certain monetary amounts, percentages, and other figures included elsewhere in this prospectus have been subject to rounding adjustments. Accordingly, figures shown as totals in certain tables or charts may not be the arithmetic aggregation of the figures that precede them, and figures expressed as percentages in the text may not total 100% or, as applicable, when aggregated may not be the arithmetic aggregation of the percentages that precede them.

USE OF PROCEEDS

We estimate that we will receive net proceeds from this offering of approximately $122.0 million (or approximately $140.8 million if the underwriters exercise their over-allotment option in full) based on the initial public offering price of $17.00 per share of common stock, after deducting underwriting discounts and commissions and estimated offering expenses payable by us.

The principal purposes of this offering are to increase our capitalization and financial flexibility, and create a public market for our common stock. We currently intend to use the net proceeds we receive from this offering for expanded research and development, infrastructure expansion, facilities expansion, headcount growth, sales and marketing expenditures, public company costs, capital expenditures, and working capital. We cannot specify with certainty all of the particular uses for the remaining net proceeds to us from this offering. We may also use a portion of the net proceeds for acquisitions or strategic investments in complementary businesses, services, products, or technologies. However, we do not have agreements or commitments to enter into any such acquisitions or investments at this time. We will have broad discretion over how to use the net proceeds to us from this offering. We intend to invest the net proceeds we receive from this offering in a variety of capital-preservation investments, including short- and intermediate-term, interest-bearing, investment-grade securities and government securities.

DIVIDEND POLICY

We have never declared or paid cash dividends on our capital stock. We currently intend to retain all available funds and future earnings, if any, to fund the development and expansion of our business, and we do not anticipate paying any cash dividends in the foreseeable future. Any future determination regarding the declaration and payment of dividends will be at the discretion of our board of directors and will depend on then-existing conditions, including our financial condition, operating results, contractual restrictions, capital requirements, business prospects, and other factors our board of directors may deem relevant. In addition, we may enter into agreements in the future that could contain restrictions on payments of cash dividends.

CAPITALIZATION

The following table sets forth our cash and cash equivalents and our capitalization as of March 31, 2019 as follows:

- on an actual basis;
- on a pro forma basis, giving effect to (i) the automatic conversion of all outstanding shares of our redeemable convertible preferred stock as of March 31, 2019 into 18,474,742 shares of common stock immediately prior to the closing of this offering, (ii) the cash exercise of a warrant to purchase 188,643 shares of our common stock, outstanding as of March 31, 2019, in full, (iii) the automatic conversion of two warrants to purchase an aggregate of 84,585 shares of our redeemable convertible preferred stock, outstanding as of March 31, 2019, into warrants to purchase an equivalent number of shares of our common stock, and the related reclassification of redeemable convertible preferred stock warrant liability to stockholders' equity, (iv) stock-based compensation expense of $0.9 million associated with outstanding stock options subject to a performance condition for which the service-based vesting condition was satisfied as of March 31, 2019 and which we will recognize in connection with this offering, and (v) the filing and effectiveness of our amended and restated certificate of incorporation that will be in effect prior to the closing of this offering; and
- on a pro forma as adjusted basis, giving effect to (i) the pro forma adjustments set forth above and (ii) the issuance and sale of 7,921,500 shares of common stock in this offering at the initial public offering price of $17.00 per share, after deducting underwriting discounts and commissions and estimated offering expenses payable by us.

The pro forma and pro forma as adjusted information below is illustrative only, and our capitalization following the closing of this offering will be adjusted based on the actual initial public offering price and other terms of this offering determined at pricing. You should read this information in conjunction with our consolidated financial statements and the related notes included in this prospectus and the "Management's Discussion and Analysis of Financial Condition and Results of Operations" section and other financial information contained in this prospectus.

	As of March 31, 2019		
	Actual	Pro Forma	Pro Forma as Adjusted
	(unaudited) (in thousands, except share and per share data)		
Cash and cash equivalents	$ 33,237	$ 33,245	$ 155,284
Long-term debt	$ 18,941	$ 18,941	$ 18,941
Convertible preferred stock warrant liability	$ 817	$ —	$ —
Series A redeemable convertible preferred stock, $0.0001 par value—31,250,000 shares authorized, 7,812,497 shares issued and outstanding, actual; no shares authorized, issued, or outstanding, pro forma and pro forma as adjusted (unaudited)	20,261	—	—
Series B redeemable convertible preferred stock, $0.0001 par value—19,288,150 shares authorized, 4,799,548 shares issued and outstanding, actual; no shares authorized, issued, or outstanding, pro forma and pro forma as adjusted (unaudited)	22,047	—	—
Series C redeemable convertible preferred stock, $0.0001 par value—24,700,000 shares authorized, 5,862,697 shares issued and outstanding, actual; no shares authorized, issued, or outstanding, pro forma and pro forma as adjusted (unaudited)	47,096	—	—
Total redeemable convertible preferred stock	$ 90,221	$ —	$ —
Stockholders' deficit:			
Preferred stock, $0.0001 par value—no shares authorized, issued, or outstanding, actual; 10,000,000 shares authorized, no shares issued or outstanding, pro forma and pro forma as adjusted (unaudited)	—	—	—
Common stock, $0.0001 par value—105,700,000 shares authorized, 3,166,316 shares issued and outstanding, actual; 200,000,000 shares authorized, 21,829,701 shares issued and outstanding, pro forma (unaudited); 200,000,000 shares authorized, 29,751,201 shares issued and outstanding, pro forma as adjusted (unaudited)	1	2	3
Additional paid-in capital	10,666	101,784	223,822
Accumulated other comprehensive income	—	—	—
Accumulated deficit	(121,190)	(122,080)	(122,080)
Total stockholders' equity (deficit)	(110,523)	(20,294)	101,745
Total capitalization	$ (1,362)	$ (1,353)	$ 120,686

The outstanding share information in the table above is based on 21,829,701 shares of our common stock (including shares of our redeemable convertible preferred stock on an as-converted basis, and assuming the exercise of a warrant to purchase 188,643 shares of our common stock) outstanding as of March 31, 2019, and excludes:

- 4,381,884 shares of our common stock issuable upon the exercise of options to purchase shares of our common stock granted under our 2011 Plan and outstanding as of March 31, 2019, with a weighted-average exercise price of $3.62 per share;
- 363,440 shares of our common stock issuable upon the exercise of options to purchase shares of our common stock granted under our 2011 Plan after March 31, 2019, with an exercise price of $13.20 per share;
- 84,585 shares of our redeemable convertible preferred stock issuable upon the exercise of warrants to purchase shares of our redeemable convertible preferred stock outstanding as of March 31, 2019, with a weighted-average exercise price of $7.13 per share;
- 65,502 shares of our common stock issuable upon the exercise of a warrant to purchase shares of our common stock outstanding as of March 31, 2019, with an exercise price of $9.16 per share;
- 7,440,524 shares of our common stock reserved for future issuance under our 2019 Plan, (including up to 5,440,524 shares of our common stock comprised of (i) the shares reserved and remaining available for issuance under our 2011 Plan that will be added to our 2019 Plan reserve upon its effectiveness plus (ii) the number of shares subject to stock options or other stock awards granted under our 2011 Plan that would have otherwise returned to our 2011 Plan, which will be added as they become available (e.g., due to forfeiture of the underlying 2011 Plan award) which includes an annual evergreen increase and will become effective in connection with this offering; and
- 250,000 shares of our common stock reserved for future issuance under our ESPP, which includes an annual evergreen increase and will become effective in connection with this offering.

DILUTION

If you invest in our common stock in this offering, your ownership interest will be immediately diluted to the extent of the difference between the initial public offering price per share and the pro forma as adjusted net tangible book value per share of our common stock after this offering.

As of March 31, 2019, we had a pro forma net tangible book value (deficit) of $(20.3) million, or $(0.93) per share. Pro forma net tangible book value per share represents the amount of our total tangible assets less our total liabilities, divided by the number of shares of our common stock outstanding as of March 31, 2019, after giving effect to the automatic conversion of all shares of our redeemable convertible preferred stock outstanding as of March 31, 2019 into 18,474,742 shares of our common stock and assuming the exercise of a warrant to purchase 188,643 shares of our common stock.

After giving further effect to the sale of 7,921,500 shares of common stock that we are offering at the initial public offering price of $17.00 per share, and after deducting underwriting discounts and commissions and estimated offering expenses payable by us, our pro forma as adjusted net tangible book value as of March 31, 2019 would have been approximately $101.7 million, or approximately $3.42 per share. This amount represents an immediate increase in pro forma net tangible book value of $4.35 per share to our existing stockholders and an immediate dilution in pro forma net tangible book value of approximately $13.58 per share to new investors purchasing shares of common stock in this offering.

Dilution per share to new investors is determined by subtracting pro forma as adjusted net tangible book value per share after this offering from the initial public offering price per share paid by new investors. The following table illustrates this dilution (without giving effect to any exercise by the underwriters of their over-allotment option):

Initial public offering price per share		$17.00
Pro forma net tangible book value (deficit) per share as of March 31, 2019	$(0.93)	
Increase in pro forma net tangible book value per share attributable to this offering	4.35	
Pro forma as adjusted net tangible book value per share after this offering		3.42
Dilution per share to new investors in this offering		$13.58

If the underwriters exercise their over-allotment option in full, the pro forma as adjusted net tangible book value after the offering would be $3.90 per share, the increase in pro forma net tangible book value per share to existing stockholders would be $4.83 per share and the dilution per share to new investors would be $13.10 per share, in each case based on the initial public offering price of $17.00 per share.

The following table summarizes on the pro forma as adjusted basis described above, as of March 31, 2019, the differences between the number of shares of common stock purchased from us by our existing stockholders and common stock by new investors purchasing shares in this offering, the total consideration paid to us in cash

and the average price per share paid by existing stockholders for shares of common stock issued prior to this offering and the price to be paid by new investors for shares of common stock in this offering. The calculation below is based on the initial public offering price of $17.00 per share, before deducting underwriting discounts and commissions and estimated offering expenses payable by us.

	Shares Purchased		Total Consideration		Average Price Per Share
	Number	Percent	Amount	Percent	
Existing stockholders	21,829,701	73.4%	$ 90,715,199	40.2%	$ 4.16
New investors	7,921,500	26.6	134,665,500	59.8	$17.00
Total	29,751,201	100%	$225,380,699	100%	

The outstanding share information in the table above is based on 21,829,701 shares of our common stock (including shares of our redeemable convertible preferred stock on an as-converted basis, and assuming the exercise of a warrant to purchase 188,643 shares of our common stock) outstanding as of March 31, 2019, and excludes:

- 4,381,884 shares of our common stock issuable upon the exercise of options to purchase shares of our common stock granted under our 2011 Plan and outstanding as of March 31, 2019, with a weighted-average exercise price of $3.62 per share;
- 363,440 shares of our common stock issuable upon the exercise of options to purchase shares of our common stock granted under our 2011 Plan after March 31, 2019, with an exercise price of $13.20 per share;
- 84,585 shares of our redeemable convertible preferred stock issuable upon the exercise of warrants to purchase shares of our redeemable convertible preferred stock outstanding as of March 31, 2019, with a weighted-average exercise price of $7.13 per share;
- 65,502 shares of our common stock issuable upon the exercise of a warrant to purchase shares of our common stock outstanding as of March 31, 2019, with an exercise price of $9.16 per share;
- 7,440,524 shares of our common stock reserved for future issuance under our 2019 Plan, (including up to 5,440,524 shares of our common stock comprised of (i) the shares reserved and remaining available for issuance under our 2011 Plan that will be added to our 2019 Plan reserve upon its effectiveness plus (ii) the number of shares subject to stock options or other stock awards granted) which includes an annual evergreen increase and will become effective in connection with this offering; and
- 250,000 shares of our common stock reserved for future issuance under our ESPP, which includes an annual evergreen increase and will become effective in connection with this offering.

To the extent any outstanding options are exercised, there will be further dilution to new investors. If all of such outstanding options had been exercised as of March 31, 2019, the pro forma as adjusted net tangible book value per share after this offering would be $3.45, and total dilution per share to new investors would be $13.55.

If the underwriters exercise their over-allotment option in full, our existing stockholders would own 70.6% and the investors purchasing shares of our common stock in this offering would own 29.4% of the total number of shares of our common stock outstanding immediately after closing of this offering.

SELECTED CONSOLIDATED FINANCIAL DATA

We derived the selected consolidated statements of operations data and consolidated balance sheets data for the fiscal years ended December 31, 2017 and 2018 from our audited consolidated financial statements included elsewhere in this prospectus. The summary consolidated statements of operations and comprehensive loss data for the three months ended March 31, 2018 and 2019 and the summary consolidated balance sheet data as of March 31, 2019 are derived from our unaudited interim condensed consolidated financial statements included elsewhere in this prospectus. We have prepared the unaudited interim condensed consolidated financial statements on the same basis as the audited financial statements and have included, in our opinion, all adjustments, consisting only of normal recurring adjustments that we consider necessary for a fair statement of the financial information set forth in those statements. The summary financial data included in this section are not intended to replace the financial statements and related notes included elsewhere in this prospectus. You should read the selected consolidated financial data set forth below in conjunction with our consolidated financial statements, the notes to our consolidated financial statements and "Management's Discussion and Analysis of Financial Condition and Results of Operations" contained elsewhere in this prospectus. Our historical results are not necessarily indicative of our future performance, and our interim results for the three months ended March 31, 2019 are not necessarily indicative of results to be expected for the full year ending December 31, 2019, or any other period.

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
	(in thousands, except share and per share data)			
Revenues	$ 9,393	$ 37,774	$ 4,164	$ 14,075
Costs and expenses				
Costs of revenues[1]	11,736	25,969	4,065	10,091
Research and development[1]	9,919	14,304	2,949	5,245
Selling, general, and administrative[1]	9,901	11,271	2,313	4,170
Total costs and expenses	31,556	51,544	9,327	19,506
Loss from operations	(22,163)	(13,770)	(5,163)	(5,431)
Interest income	100	293	61	84
Interest expense	(1,303)	(1,894)	(622)	(184)
Loss on debt extinguishment	—	(4,658)	—	—
Other (expense) income, net	(227)	150	351	(152)
Loss before income taxes	(23,593)	(19,879)	(5,373)	(5,683)
Provision for income taxes	(5)	(7)	(2)	(2)
Net loss	$ (23,598)	$ (19,886)	$ (5,375)	$ (5,685)
Net loss per share, basic and diluted[2]	$ (7.78)	$ (6.49)	$ (1.76)	$ (1.84)
Weighted-average shares outstanding, basic and diluted[2]	3,031,636	3,063,157	3,051,581	3,091,342
Pro forma net loss per share, basic and diluted (unaudited)[2]		$ (0.95)		$ (0.26)
Pro forma weighted-average shares outstanding, basic and diluted (unaudited)[2]		20,483,543		21,754,727

(1) Includes stock-based compensation as follows:

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
	(in thousands)			
Costs of revenues	$ 74	$ 177	$ 24	$ 85
Research and development	225	429	64	164
Selling, general, and administrative	454	711	81	360
Total stock-based compensation expense	$ 753	$ 1,317	$ 169	$ 609

(2) See the consolidated statements of operations and Note 15 to our consolidated financial statements included elsewhere in this prospectus for an explanation of the method used to compute the historical and pro forma net loss per share and the number of shares used in the computation of the per share amounts.

	As of December 31,		As of March 31,	
	2017	2018	2018	2019
			(unaudited)	
	(in thousands)			
Consolidated Balance Sheet Data:				
Cash and cash equivalents	$ 22,617	$ 19,744	$ 21,844	$ 33,237
Working capital(1)	(22,262)	(28,291)	(29,162)	(15,348)
Total assets	33,563	41,670	35,302	57,647
Redeemable convertible preferred stock warrant liability	292	683	292	817
Additional paid-in capital	3,025	9,131	3,220	10,666
Accumulated deficit	(95,619)	(115,505)	(100,995)	(121,190)
Total stockholders' deficit	(92,603)	(106,388)	(97,780)	(110,523)

(1) Working capital is defined as total current assets less total current liabilities. See our consolidated financial statements and the related notes included elsewhere in this prospectus for further details regarding our current assets and current liabilities.

MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The following Management's Discussion and Analysis of Financial Condition and Results of Operations should be read together with our consolidated financial statements and accompanying notes included elsewhere within this prospectus. This discussion includes both historical information and forward-looking information that involves risk, uncertainties, and assumptions. Our actual results may differ materially from management's expectations as a result of various factors, including, but not limited to, those discussed in the section titled "Risk Factors."

Overview

We are a growing cancer genomics company transforming the development of next-generation therapies by providing more comprehensive molecular data about each patient's cancer and immune response. We designed our NeXT Platform to adapt to the complex and evolving understanding of cancer, providing our biopharmaceutical customers with information on all of the approximately 20,000 human genes, together with the immune system, in contrast to many cancer panels that cover roughly 50 to 500 genes. We are also developing a complementary liquid biopsy assay that analyzes all human genes versus the more narrowly focused liquid biopsy assays that are currently available. By combining technological innovation, operational scale, and regulatory differentiation, our NeXT Platform is designed to help our customers obtain new insights into the mechanisms of response and resistance to therapy as well as new potential therapeutic targets. Our platform enhances the ability of biopharmaceutical companies to unlock the potential of conducting translational research in the clinic rather than with pre-clinical animal models or cancer cell lines. We are also planning to release a diagnostic based on our NeXT Platform that we envision being used initially by biopharmaceutical customers and clinical collaborators. Since inception, we have provided our services to more than 45 biopharmaceutical customers, including several of the largest pharmaceutical companies in the world.

We have focused on human genome sequencing since our inception in 2011. In 2013, we introduced our patented ACE Exome technology, providing enhanced and more complete coverage over all of the approximately 20,000 human genes. The superior performance of ACE Exome technology compared to other exomes was described in Genome Medicine and Nature Review publications.

In November 2016, we launched our ACE ImmunoID product, the first generation of our immuno-oncology genomics platform that combined our ACE exome and transcriptome technology with analytics to provide a more comprehensive tumor profiling solution for biopharma customers conducting cancer clinical trials and translational research. With ACE ImmunoID for Personalized Cancer Therapy, we further enhanced the platform for personalized cancer therapy customers with additional neoantigen analytics, improved turnaround times, and access to a Device Master File that we filed with the U.S. Food and Drug Administration. With the ACE ImmunoID for Biomarkers, we extended the platform further with ImmunogenomicsID, a broad immuno-genomics biomarker analysis engine. In November 2018, we announced ImmunoID NeXT, our universal cancer immunogenomics platform, which is the first technology to enable comprehensive analysis of both a tumor and its immune microenvironment from a single sample and provides utility across immuno-oncology, targeted, and personalized therapies. We expect to do a full commercial launch of ImmunoID NeXT in 2019.

In parallel with the work described above, we also developed multiple clinical diagnostic tests. Clinical diagnostic testing has remained a small portion of our business, primarily because we have elected not to expend the time and resources necessary to secure third-party reimbursement, choosing instead to pursue more immediate revenue opportunities. Nevertheless, it has helped us to develop important capabilities that do not depend on third-party reimbursement. In June 2015, we launched our ACE CancerPlus Test based on a 1,400-gene panel. We plan to build on this experience in 2019 by introducing a clinical diagnostic test based on our ImmunoID NeXT Platform, which will include all of the approximately 20,000 human genes and will be targeted initially to biopharmaceutical customers.

In parallel with the development of our platform technology, we have also provided DNA sequencing and analysis services under contract with the U.S. Department of Veterans Affairs (the "VA") Million Veteran Program (the "VA MVP"), beginning in 2012. This relationship with the VA MVP has enabled us to innovate, scale our operational infrastructure, and achieve greater efficiencies in our lab.

Our customers include large-cap pharmaceutical companies, emerging biotechnology companies, universities, non-profit medical research institutes, and government entities. We generated revenues of $9.4 million and $37.8 million for the years ended December 31, 2017 and 2018, respectively, and $4.2 million and $14.1 million for the three months ended March 31, 2018 and 2019, respectively. In 2018, 49% of our revenues were generated from VA MVP. Non-VA MVP revenues increased by 114% in 2018 compared to 2017. For the three months ended March 31, 2019, 59% of our revenues were generated from VA MVP. Non-VA MVP revenues increased by 162% in the three months ended March 31, 2019 compared to the three months ended March 31, 2018. Our top five customers represented 45% and 82% of revenues in 2017 and 2018, respectively, and 76% and 90% of revenues for the three months ended March 31, 2018 and 2019, respectively.

We also incurred net losses of $23.6 million and $19.9 million for the years ended December 31, 2017 and 2018, respectively, and net losses of $5.4 million and $5.7 million for the three months ended March 31, 2018 and 2019, respectively.

As of March 31, 2019, we had $33.2 million in cash and cash equivalents. From inception through March 31, 2019, we have funded our operations primarily through cash from operations, redeemable convertible preferred stock issuances, and debt issuances. After giving effect to the anticipated net proceeds from this offering, we expect that our existing cash and cash equivalents, anticipated cash flow from operations, and our $20.0 million financing facility will provide sufficient funds to sustain operations through at least the next 12 months. We have based these estimates on assumptions that may prove to be wrong, and we could exhaust our available capital resources sooner than we expect. See the section titled "Liquidity and Capital Resources; Plan of Operations."

Factors Affecting Our Performance

We believe there are several important factors that have impacted and that we expect will impact our operating performance and results of operations, including:

- **The continued development of the market for genomic-based tests.** Our performance depends on the willingness of biopharmaceutical customers to continue to seek more comprehensive molecular information to develop more efficacious cancer therapies.
- **Increasing adoption of our products and solutions by existing customers.** Our performance depends on our ability to retain and broaden adoption with existing customers. Because our technology is novel, some customers begin using our platform by initiating pilot studies involving a small number of samples to gain experience with our service. As a result, historically a significant portion of our revenues has come from existing customers. We believe that our ability to convert initial pilots into larger orders from existing customers has the potential to drive substantial long-term revenue. We expect there may be some variation in the number of samples they choose to test each quarter.
- **Adoption of our products and solutions by new customers.** While new customers initially may not account for significant revenues, we believe that they have the potential to grow substantially over the long term as they gain confidence in our service. Our ability to engage new customers is critical to our long-term success. Our publications, posters and presentations at scientific conferences lead to engagement at the scientific level with potential customers who often make the initial decision to gain experience with our platform. Accessing these new customers through scientific engagement and marketing to gain initial buy-in is critical to our success and gives us the opportunity to demonstrate the utility of our platform.

- **Our revenues and costs are affected by the volume of samples we receive from customers from period to period.** The timing and size of sample shipments received after orders have been placed is variable. Since sample shipments can be large, and are often received from a third party, the timing of arrival can be difficult to predict over the short term. Although our long-term performance is not affected, we do see quarter-to-quarter volatility due to these factors. Samples arriving later than expected may not be processed in the quarter proposed and result in revenue the following quarter. Since many of our customers request defined turnaround times, we employ project managers to coordinate and manage the complex process from sample receipt to sequencing and delivery of results. Our business can be seasonal, as we historically have received fewer samples during July and August.
- **Investment in product innovation to support commercial growth.** Investment in research and development, including the development of new products is critical to establish and maintain our leading position. In particular, we have invested in NeoantigenID, a neoantigen characterization report, ImmunogenomicsID, a broad biomarker report, and ImmunoID NeXT, our universal cancer immunogenomics platform. We are also collaborating with investigators from academic cancer centers, such as Inova Health System, Stanford Medicine, and the Parker Institute for Cancer Immunotherapy, to support the utility of our platform. We believe this work is critical to gaining customer adoption and expect our investments in these efforts to increase. We believe utility for our product may result in additional expenditures to develop and market new products, including a diagnostic or database.
- **Leverage our operational infrastructure.** We have invested significantly, and will continue to invest, in our sample processing capabilities and commercial infrastructure. With our current operating model and infrastructure, we can increase our production and commercialize new generations of our platform, but as our volumes continue to increase we will ultimately need to invest in additional production capabilities. We expect to grow our revenues and spread our costs over a larger volume of services. In addition, we may invest significant amounts in infrastructure to support new products resulting from our research and development activities.

Components of Operating Results

Revenues

We derive our revenues primarily from sequencing and data analysis services to support the development of next-generation cancer therapies. We support our customers by providing high-accuracy, validated genomic sequencing and advanced analytics. Many of these analytics are related to state-of-the-art biomarkers, including those relevant to immuno-oncology therapeutics such as checkpoint inhibitors.

Our revenues are primarily generated through contracts with companies in the pharmaceutical industry, healthcare organizations, and government entities. Our ability to increase our revenues will depend on our ability to further penetrate this market. To do this, we are developing a growing set of additional state-of-the-art products, advancing our operational infrastructure, building our regulatory credentials and expanding our targeted marketing efforts. Unlike diagnostic or therapeutic companies, we have not to date sought reimbursement through traditional healthcare payors. We sell through a small direct sales force.

We have one reportable segment from the sale of sequencing and data analysis services. Substantially all of our revenues to date have been derived from sales in the United States.

Revenues by customer type

Revenues by customer type were as follows:

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
	(in thousands)			
VA MVP	$ 421	$18,601	$1,977	$ 8,343
All other customers	8,972	19,173	2,187	5,732
Total	$9,393	$37,774	$4,164	$14,075

Revenues concentration

Our top five customers represented 45% and 82% of revenues in 2017 and 2018, respectively. Our top five customers represented 76% and 90% of revenues for the three months ended March 31, 2018 and 2019, respectively. Customers that accounted for equal to or greater than 10% of revenues in 2017 or 2018 and for the three months ended March 31, 2018 and 2019 were as follows:

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
VA MVP	*	49%	47%	59%
Merck & Co., Inc.	11%	12%	12%	*
Pfizer Inc.	*	10%	*	17%
Customer A	13%	*	*	*
Customer B	10%	*	*	*

* Less than 10% of revenues.

Accounts receivable concentration

As of December 31, 2017 and 2018 and as of March 31, 2018 and 2019, customers that accounted for greater than 10% of accounts receivable were as follows:

	As of December 31,		As of March 31,	
	2017	2018	2018	2019
Pfizer Inc.	13%	33%	11%	47%
Customer A	*	17%	*	*
Merck & Co., Inc.	38%	10%	22%	*
Customer B	*	10%	*	*
Customer C	13%	*	*	20%
VA MVP	*	*	38%	*

* Less than 10% of accounts receivable.

Costs and Expenses

Costs of revenues

Costs of revenues consist of production material costs, personnel costs (salaries, bonuses, benefits, and stock-based compensation), costs of consumables, laboratory supplies, depreciation and service maintenance on capitalized equipment, and information technology (“IT”) and facility costs. We expect the costs of revenues to increase as our revenues grow, but the cost per unit of data delivered to decrease over time due to economies of scale we may gain as volume increases, automation initiatives, and other cost reductions.

Research and development expenses

Research and development expenses consist of costs incurred for the development of our products. These expenses consist primarily of payroll and personnel costs (salaries, bonuses, benefits, and stock-based compensation), costs of consumables, laboratory supplies, depreciation and service maintenance on capitalized equipment, and IT and facility costs. These expenses also include costs associated with our collaborations, which we expect to increase over time.

We expense our research and development expenses in the period in which they are incurred. We expect to increase our research and development expenses as we continue to develop new products.

Selling, general, and administrative expenses

Selling expenses consist of personnel costs, customer support expenses, direct marketing expenses, educational and promotional expenses, and market research. Our general and administrative expenses include costs for our executive, accounting, finance, legal, and human resources functions. These expenses consist of personnel costs, audit and legal expenses, consulting costs, and IT and facility costs. We expense all selling, general, and administrative expenses as incurred.

We expect our selling expenses will continue to increase in absolute dollars, primarily driven by our efforts to expand our commercial capability and to expand our brand awareness and customer base through targeted marketing initiatives with an increased presence both within and outside the United States. We also expect general and administrative expenses will increase as we scale our operations. In addition, we expect to incur additional accounting, legal, director and officer insurance, and other expenses as a public company that we did not incur as a private company.

Interest Income

Interest income consists primarily of interest earned on our cash and cash equivalents.

Interest Expense

Interest expense primarily consists of cash and non-cash interest costs related to our term loan, convertible promissory notes, and revolving loan. We record costs incurred in connection with the issuance of debt as a direct deduction from the debt liability. We amortize these costs over the term of our debt agreements as interest expense in our consolidated statements of operations.

Loss on Debt Extinguishment

We incurred a loss on debt extinguishment in 2018 resulting from changes in the maturity dates of the convertible notes issued in 2017. See Note 6 to our consolidated financial statements included elsewhere in this prospectus.

Other Income (Expense), Net

Other income (expense), net consists of changes in the fair value of the compound derivative instrument, changes in fair value of convertible preferred stock warrant liability, and foreign currency exchange gains and losses. We expect our foreign currency gains and losses to continue to fluctuate in the future due to changes in foreign currency exchange rates.

Results of Operations

Comparison of the Years Ended December 31, 2017 and 2018 and the Three Months Ended March 31, 2018 and 2019

The following table summarizes our results of operations for the periods indicated:

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
	(in thousands, except share and per share data)			
Revenues	$ 9,393	$ 37,774	$ 4,164	$ 14,075
Costs and expenses				
Costs of revenues	11,736	25,969	4,065	10,091
Research and development	9,919	14,304	2,949	5,245
Selling, general, and administrative	9,901	11,271	2,313	4,170
Total costs and expenses	31,556	51,544	9,327	19,506
Loss from operations	(22,163)	(13,770)	(5,163)	(5,431)
Interest income	100	293	61	84
Interest expense	(1,303)	(1,894)	(622)	(184)
Loss on debt extinguishment	—	(4,658)	—	—
Other (expense) income, net	(227)	150	351	(152)
Loss before income taxes	(23,593)	(19,879)	(5,373)	(5,683)
Provision for income taxes	(5)	(7)	(2)	(2)
Net loss	$ (23,598)	$ (19,886)	$ (5,375)	$ (5,685)
Net loss per share, basic and diluted	$ (7.78)	$ (6.49)	$ (1.76)	$ (1.84)
Weighted-average shares outstanding, basic and diluted	3,031,636	3,063,157	3,051,581	3,091,342
Pro forma net loss per share, basic and diluted (unaudited)		$ (0.95)		$ (0.26)
Pro forma weighted-average shares outstanding, basic and diluted (unaudited)		20,483,543		21,754,727

Revenues

Comparison of the Years Ended December 31, 2017 and 2018

Revenues were $9.4 million for the year ended December 31, 2017 compared to $37.8 million for the year ended December 31, 2018, an increase of $28.4 million, or 302%. This increase in revenues was primarily due to an increase in the volume of samples we tested in relation to the sequencing and data analysis services we provided to our customers. The increase in samples tested was primarily due to additional volume from both existing and new customers, including an increase in the number of projects per customer. For the year ended December 31, 2018, revenues from existing customers and existing projects accounted for 58% of total revenues, and the remaining 42% of revenues was generated from new projects from our existing customers and new customers acquired in 2018.

Comparison of the Three Months Ended March 31, 2018 and 2019

Revenues were $4.2 million for the three months ended March 31, 2018 compared to $14.1 million for the three months ended March 31, 2019, an increase of $9.9 million, or 236%. This increase in revenues was primarily due to an increase in the volume of samples we tested in relation to the sequencing and data analysis services we provided to our customers. The increase in samples tested was primarily due to additional volume from both existing and new customers, including an increase in the number of projects per customer. For the three months ended March 31, 2019, revenues from existing customers and existing projects accounted for 10% of total revenues, and the remaining 90% of revenues was generated from new projects from our existing customers and new customers acquired in 2018 and 2019.

Costs of Revenues

Comparison of the Years Ended December 31, 2017 and 2018

Costs of revenues were $11.7 million for the year ended December 31, 2017 compared to $26.0 million for the year ended December 31, 2018, an increase of $14.3 million, or 121%. This increase was primarily due to the increase in revenues discussed above. The cost components related to the increase in costs of revenues were an increase in production materials of $9.6 million, an increase in depreciation and service maintenance on capitalized equipment of $2.0 million, an increase in expensed equipment, consumables, and laboratory supplies of $1.2 million, an increase related to personnel costs including salaries, bonuses, benefits, and stock-based compensation expenses of $1.0 million, and an increase in IT and facility costs of $0.5 million.

Comparison of the Three Months Ended March 31, 2018 and 2019

Costs of revenues were $4.1 million for the three months ended March 31, 2018 compared to $10.1 million for the three months ended March 31, 2019, an increase of $6.0 million, or 146%. This increase was primarily due to the increase in revenues discussed above. The cost components related to the increase in costs of revenues were an increase in production materials of $3.7 million, an increase related to personnel costs including salaries, bonuses, benefits, and stock-based compensation expenses of $1.1 million, an increase in depreciation and service maintenance on capitalized equipment of $0.6 million, an increase in the consumption cost of expensed equipment, consumables, and laboratory supplies of $0.4 million, and an increase in IT and facility costs of $0.2 million.

Research and Development Expenses

Comparison of the Years Ended December 31, 2017 and 2018

Research and development expenses were $9.9 million for the year ended December 31, 2017 compared to $14.3 million for the year ended December 31, 2018, an increase of $4.4 million, or 44%. This was primarily due to increased development activities for new product offerings, lab and automation development costs, and IT and facility costs. Research and development expenses increased due to an increase of $2.3 million in personnel-related expenses, including salaries, bonuses, benefits, and stock-based compensation expenses, a $1.1 million increase in IT and facility costs, a $0.8 million increase in laboratory and automation supplies consumed and equipment, and a $0.2 million increase in other costs.

Comparison of the Three Months Ended March 31, 2018 and 2019

Research and development expenses were $2.9 million for the three months ended March 31, 2018 compared to $5.2 million for the three months ended March 31, 2019, an increase of $2.3 million, or 79%. This was primarily due to increased development activities for new product offerings, lab and automation development costs, and IT and facility costs. Research and development expenses increased due to an increase of

$0.9 million in personnel-related expenses, including salaries, bonuses, benefits, and stock-based compensation expenses, a $0.9 million increase in laboratory and automation supplies consumed and equipment, a $0.3 million increase in depreciation and service maintenance on capitalized equipment and a $0.2 million increase in IT and facility costs.

Selling, General, and Administrative Expenses

Comparison of the Years Ended December 31, 2017 and 2018

Selling, general, and administrative expenses were $9.9 million for the year ended December 31, 2017 compared to $11.3 million for the year ended December 31, 2018, an increase of $1.4 million, or 14%. Selling, general, and administrative expenses increased due to a $1.0 million increase in personnel-related expenses including salaries, bonuses, benefits, and stock-based compensation expenses, a $0.2 million increase in professional services, and a $0.2 million increase in other costs.

Comparison of the Three Months Ended March 31, 2018 and 2019

Selling, general, and administrative expenses were $2.3 million for the three months ended March 31, 2018 compared to $4.2 million for the three months ended March 31, 2019, an increase of $1.9 million, or 83%. Selling, general, and administrative expenses increased due to a $1.3 million increase in personnel-related expenses including salaries, bonuses, benefits, and stock-based compensation expenses, a $0.5 million increase in professional services, and a $0.1 million increase in other costs.

Other Income (Expenses), Net

	Year Ended December 31,		Change	Three Months Ended March 31,		Change
	2017	2018	$	2018	2019	$
	(in thousands)			(unaudited)		
Changes in fair values of warrants for Series B and Series C convertible preferred stock	$ (64)	$ (391)	$ (327)	$ —	$ 134	$ 134
Changes in fair value of the compound derivative instrument	(162)	574	736	353	—	(353)
Other	(1)	(33)	(32)	(2)	18	20
Total other (expenses) income, net	$(227)	$ 150	$ 377	$ 351	$ 152	$ (199)

Comparison of the Years Ended December 31, 2017 and 2018

We had other expense, net of $0.2 million for the year ended December 31, 2017, compared to other income, net of $0.2 million for the year ended December 31, 2018, an increase of approximately $0.4 million, or 166.1%. This increase was driven by a decrease in the fair value of a compound derivative instrument of approximately $0.7 million in 2018, partially offset by an increase in the fair values of warrants for Series B and Series C redeemable convertible preferred stock of approximately $0.3 million.

Comparison of the Three Months Ended March 31, 2018 and 2019

We had other income, net of $0.4 million for the three months ended March 31, 2018, compared to other income, net of $0.2 million for the three months ended March 31, 2019. The decrease was primarily driven by a $0.4 million decrease in fair value of the compound derivative instrument partially offset by a $0.1 million increase in the fair values of warrants for Series B and Series C redeemable convertible preferred stock.

Liquidity and Capital Resources; Plan of Operations

Sources of Liquidity

From our inception through March 31, 2019, we have funded our operations primarily from $89.6 million from issuance of redeemable convertible preferred stock, as well as cash from operations and debt financing. In the year ended December 31, 2017, we received $12.2 million in gross cash proceeds from the issuance of convertible notes, and $5.0 million in gross cash proceeds from a revolving loan. On March 22, 2019, we received $20.0 million in gross cash proceeds from a growth capital loan. As of March 31, 2019, we had cash and cash equivalents in the amount of $33.2 million.

Future Funding Requirements

We have incurred net losses since our inception. For the years ended December 31, 2017 and 2018, we had net losses as of $23.6 million and $19.9 million, respectively, and for the three months ended March 31, 2018 and 2019, we had net losses of $5.4 million and $5.7 million, respectively, and we expect to incur additional losses in future periods. As of March 31, 2019, we had an accumulated deficit of $121.2 million. We believe that our existing cash, cash investments and anticipated cash flow from operations will provide sufficient funds to sustain operations through at least the next 12 months. See Note 16 to our audited consolidated financial statements included elsewhere in this prospectus.

We have based these future funding requirements on assumptions that may prove to be wrong, and we could utilize our available capital resources sooner than we expect. If our available cash balances, net proceeds from this offering and anticipated cash flow from operations are insufficient to satisfy our liquidity requirements including because of lower demand for our services or other risks described in this prospectus, we may seek to sell additional common or preferred equity or convertible debt securities, enter into an additional credit facility or another form of third-party funding or seek other debt financing. The sale of equity and convertible debt securities may result in dilution to our stockholders and, in the case of preferred equity securities or convertible debt, those securities could provide for rights, preferences or privileges senior to those of our common stock. The terms of debt securities issued or borrowings pursuant to a credit agreement could impose significant restrictions on our operations. Additional capital may not be available on reasonable terms, or at all.

The expected use of the net proceeds from this offering represents our intentions based upon our current plans and business conditions. However, we have based these estimates on assumptions that may prove to be wrong, and we could use our capital resources sooner than we expect.

Term Loan

In September 2014, we entered into a loan and security agreement with a bank (the “Term Loan”), to borrow up to $3.0 million under an equipment loan secured by the equipment financed. On October 3, 2014, we borrowed $2.4 million under this loan agreement. The Term Loan required 12 interest-only payments, followed by 36 equal monthly installments of principal, plus interest, which began on October 3, 2015.

In connection with the Term Loan, we issued a 10-year warrant to purchase 22,489 shares of our Series B redeemable convertible preferred stock at an exercise price of $4.60 per share.

On September 30, 2018, the Term Loan was repaid in full.

Revolving Loan

In June 2017, we entered into a $10.0 million revolving loan and security agreement (the “Revolving Loan”) with TriplePoint Capital LLC (“TriplePoint”). Borrowings under the Revolving Loan had an interest rate of

prime, plus 6.75%. The Revolving Loan also had a 5.5% end of term loan payment on the highest outstanding principal amount. The Revolving Loan required monthly interest-only payments until the maturity date. The Revolving Loan's original maturity date was December 31, 2018 and in December 2018 the maturity date was further extended until March 22, 2019. See Note 16 to our consolidated financial statements included elsewhere in this prospectus. The maturity date of the extension of the Revolving Loan was not deemed substantial therefore we accounted for the transaction as a debt modification.

As of both December 31, 2017 and 2018, our outstanding principal under the Revolving Loan was $5.0 million and $5.0 million was available to borrow.

In connection with the Revolving Loan, we issued a warrant to purchase up to 62,096 shares of our Series C redeemable convertible preferred stock at an exercise price of $8.052 per share. See Note 5 to our consolidated financial statements included elsewhere in this prospectus.

The Revolving Loan had an effective interest rate of 19.22% per year. The Revolving Loan interest expenses for the years ended December 31, 2017 and 2018 were $0.4 million and $0.9 million, respectively.

In March 2019, we entered into an amendment to the Revolving Loan with TriplePoint that provided for a $20.0 million growth capital loan facility (the "Growth Capital Loan"). In March 2019, we used $5.3 million of the Growth Capital Loan to repay all amounts owing in respect of the Revolving Loan.

Growth Capital Loan

On March 22, 2019, we entered into the Growth Capital Loan with TriplePoint to provide for a $20.0 million growth capital loan facility and as of March 31, 2019, had drawn down the full $20.0 million available under the facility. We used $5.3 million of the Growth Capital Loan to repay, in its entirety, all amounts outstanding under the Revolving Loan. Borrowings under the Growth Capital Loan bear interest at a floating rate of prime rate plus 5.00% for borrowings up to $15.0 million and the prime rate plus 6.50% for borrowing greater than $15.0 million; provided, however, that in an event of default, as defined in the loan and security agreement, the interest rate applicable to borrowings under such agreement will be increased by 5.0%. Under the agreement, we are required to make monthly interest-only payments through April 1, 2020 and are required to make 36 equal monthly payments of principal, plus accrued interest, from April 1, 2020 through March 1, 2023, when all unpaid principal and interest becomes due and payable. We may voluntarily prepay all, but not part, of the outstanding principal at any time prior to the maturity date, subject to a prepayment fee of 1% of the outstanding balance, if prepaid in months one through 12 of the loan term. If prepaid after month 12 of the loan term of any growth capital loan, no additional prepayment premium shall be due. In addition to the final payment, we will pay an amount equal to 2.75% of each principal amount drawn under this growth capital loan facility. In connection with the Growth Capital Loan, we issued a warrant to purchase 65,502 shares of common stock to the lender at an exercise price of $9.16 per share. We recorded the issuance-date fair value of the warrant of $0.6 million and fees paid to the lender of $0.3 million as a debt discount which is amortized over the term of the Growth Capital Loan using the effective interest rate method.

Upon issuance, the Growth Capital Loan had an effective interest rate of 15.23% per year.

Convertible Notes

On June 29, 2017, we entered into a convertible promissory note agreements (the "Convertible Notes") with certain existing redeemable convertible preferred stockholders and third parties (the "Investors") for the issuance of convertible promissory notes with a face value of $12.2 million. Under the terms of the Convertible Notes agreement, the Convertible Notes bear interest of 8% per annum, with a maturity date of June 28, 2018. In the event that we issued and sold shares of its equity securities (the "Equity Securities") to Investors on or before the maturity date in an equity financing with total proceeds to us of not less than $10 million (including the

conversion of the Convertible Notes or other convertible securities issued for capital raising purposes) (a "Qualified Financing"), then the outstanding principal amount of the Convertible Notes and any unpaid accrued interest would have automatically converted in whole without any further action by the holder into such Equity Securities sold in the Qualified Financing at a conversion price equal to the price paid per share for Equity Securities by the Investors in the Qualified Financing multiplied by 0.8. If we consummated a change of control while the Convertible Notes remained outstanding, we would have repaid the holders in cash an amount equal to 150% of the outstanding principal amount of the Convertible Notes, plus any unpaid accrued interest on the original principal. The Convertible Notes had customary events of default.

The conversion options of the Convertible Notes did not meet the requirements for separate accounting as an embedded derivative. However, the redemption features of the Convertible Notes met the requirements for separate accounting and were accounted for as a single, compound derivative instrument (see Note 9). The compound derivative instrument was recorded at fair value at inception and was subject to remeasurement to fair value at each consolidated balance sheet date, with any changes in fair value recognized in the consolidated statements of operations. The estimated fair value of the compound derivative instrument at issuance was recorded as a reduction in the carrying value of the Convertible Notes and as a single compound derivative liability. The Convertible Notes carrying value reduction was accreted using the effective interest method as interest expense over the Convertible Notes contractual period of one year. The Convertible Notes had an effective interest rate of 12.69% per year.

On May 31, 2018, the original maturity date for the Convertible Notes was extended to June 28, 2019 (previously June 28, 2018). The maturity date extension was deemed substantial and was accounted for as a debt extinguishment under Accounting Standards Codification ("ASC") Topic 470, *Debt*. In connection with the debt extinguishment on May 31, 2018, the fair value of the Convertible Notes was allocated between the carrying amount of the Convertible Notes and accrued interested of $13.1 million, a compound derivative asset of $0.6 million, and an equity component of $3.9 million, which was credited to additional paid-in capital within the consolidated statements of redeemable convertible preferred stock and stockholders' deficit. The transaction also resulted in a $3.3 million loss recorded as debt extinguishment in the accompanying consolidated statements of operations. The new carrying value of the Convertible Notes was accreted using the effective interest method as interest expense over the new contractual period of 1.1 years.

On August 20, 2018, the maturity date for the Convertible Notes was changed to September 20, 2018 (previously June 28, 2019). The term change was deemed substantial and was accounted for as a debt extinguishment under ASC Topic 470. In connection with the debt extinguishment on August 20, 2018, the fair value of the Convertible Notes was allocated between the new carrying amount of the Convertible Notes and accrued interest of $13.4 million, and an equity component of $0.8 million, which resulted in an additional credit to additional paid-in capital. The transaction also resulted in a $0.8 million loss recorded as debt extinguishment in the accompanying consolidated statements of operations. The new carrying value of the Convertible Notes was accreted using the effective interest method as interest expense over the new contractual period of one month.

On September 20, 2018, upon the maturity of the Convertible Notes, the carrying amount, including accrued interest of $13.4 million was converted into 1,667,997 shares of our Series C redeemable convertible preferred stock at a conversion price equal to $8.052 per share. No gain or loss was recorded on the conversion.

The interest expense on the Convertible Notes for the years ended December 31, 2017 and 2018, was $0.7 million and $0.9 million, respectively.

Summary Consolidated Statements of Cash Flows

The following table sets forth the primary sources and uses of cash and cash equivalents for each of the periods presented below:

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
	(in thousands)			
Net cash provided by operating activities	$ 290	$ 5,572	$ 723	$ 66
Net cash used in investing activities	(5,158)	(7,852)	(1,309)	(960)
Net cash provided by (used in) financing activities	16,404	(591)	(189)	14,386

Net Cash Provided by Operating Activities

Net cash provided by operating activities during the year ended December 31, 2017 was $0.3 million, which resulted from a net loss of $23.6 million, offset by non-cash charges of $3.1 million and net change in our operating assets and liabilities of $20.8 million. Non-cash charges primarily consisted of $1.2 million of depreciation and amortization expense, $0.8 million of stock-based compensation expense, and $1.2 million of non-cash interest expense, change in fair value of compound derivative instrument and convertible preferred stock warrant liability. The net change in our operating assets and liabilities was primarily the result of a $19.1 million increase in customer deposits related to customer prepayments, a $3.3 million increase in accounts payable and accrued liabilities to support inventory and general expenses, partially offset by a $1.2 million increase in accounts receivables related to increases in revenue, a $0.5 million increase in inventory and deferred cost balances, and a decrease of $0.2 million in prepaid expense and other assets.

Net cash provided by operating activities during the year ended December 31, 2018 was $5.6 million, which resulted from a net loss of $19.9 million, offset by non-cash charges of $10.0 million and net change in our operating assets and liabilities of $15.4 million. Non-cash charges primarily consisted of $4.7 million of loss of debt extinguishment, $3.1 million of depreciation and amortization expense, $1.3 million of stock-based compensation expense, and $1.2 million of accretion of noncash interest, partially offset by $0.2 million of change in fair value of compound derivative instrument and convertible preferred stock warrant liability. The net change in our operating assets and liabilities was primarily the result of a $18.2 million increase in customer deposits related to customer prepayments, a $3.2 million increase in accounts payable and accrued liabilities to support inventory, and general expenses, partially offset by a $2.5 million increase in accounts receivables related to increases in revenue, a $2.1 million increase in inventory and deferred cost balances, and a $1.3 million decrease in prepaid expense and other assets.

Net cash provided by operating activities during the three months ended March 31, 2018 was $0.7 million, which resulted from a net loss of $5.4 million, offset by non-cash charges of $0.7 million and net change in our operating assets and liabilities of $5.3 million. Non-cash charges primarily consisted of $0.5 million of depreciation and amortization expense, $0.2 million of stock-based compensation expense, and $0.5 million of accretion of noncash interest, partially offset by $0.4 million of change in fair value of compound derivative instrument and convertible preferred stock warrant liability. The net change in our operating assets and liabilities was primarily the result of a $6.3 million increase in customer deposits related to customer prepayments, a $0.2 million decrease in accounts payable and accrued liabilities to support inventory, and general expenses, partially offset by a $0.2 million increase in accounts receivables related to increases in revenue, and a $1.0 million decrease in inventory and other deferred cost balances.

Net cash provided by operating activities during the three months ended March 31, 2019 was $0.1 million, which resulted from a net loss of $5.7 million, offset by non-cash charges of $2.0 million and net change in our

operating assets and liabilities of $3.7 million. Non-cash charges primarily consisted of $1.0 million of depreciation and amortization expense, $0.6 million of stock-based compensation expense, $0.2 million of change in fair value of convertible preferred stock warrant liability and change in accretion of noncash interest and debt reduction and $0.2 million of change in noncash lease expense. The net change in our operating assets and liabilities was primarily the result of a $1.4 million increase in customer deposits related to customer prepayments, a $0.8 million increase in accounts payable and accrued liabilities to support inventory, and general expenses, partially offset by a $1.3 million increase in accounts receivables related to increase in revenues, a $0.6 million increase in inventory and other deferred cost balances, and a $0.4 million decrease in prepaid expense and other assets.

Net Cash Used in Investing Activities

Net cash used in investing activities for 2017 was $5.2 million, which was primary related to the acquisition of property and equipment used for our sequencing and data analysis services.

Net cash used in investing activities for 2018 was $7.9 million, which was primary related to the acquisition of property and equipment used for our sequencing and data analysis services and facility expansion to support expanded operations.

Net cash used in investing activities for the three months ended March 31, 2018 was $1.3 million, which was primary related to the acquisition of property and equipment used for our sequencing and data analysis services and facility expansion to support expanded operations.

Net cash used in investing activities for the three months ended March 31, 2019 was $1.0 million, which was primary related to the acquisition of property and equipment used for our sequencing and data analysis services and facility expansion to support expanded operations.

Net Cash Provided by (Used in) Financing Activities

Net cash provided by financing activities was $16.4 million for the year ended December 31, 2017, which primarily consisted of $5.0 million borrowings under the Revolving Loan and $12.2 million from the Convertible Notes, partially offset by $0.8 million in debt repayment.

Net cash used in financing activities was $0.6 million for the year ended December 31, 2018, which primarily consisted of debt repayment.

Net cash used in financing activities was $0.2 million for the three months ended March 31, 2018, which primarily consisted of debt repayment.

Net cash provided by financing activities was $14.4 million for the three months ended March 31, 2019, which primarily consisted of $20.0 million borrowings under the Growth Capital Loan and $0.4 million from proceeds of exercise of stock options, partially offset by $5.0 million in debt repayment, $0.5 million in debt issuance costs, and $0.5 million in payment costs related to our initial public offering.

Contractual Obligations and Commitments

The following table summarizes our non-cancelable contractual obligations and commitments as of December 31, 2018:

	Payments Due by Period				
	Less than 1 year	1 to 3 years	3 to 5 years	More than 5 years	Total
	(in thousands)				
Debt obligations(1)	$ 5,270	$ —	$ —	$ —	$ 5,270
Operating lease obligations(2)	1,091	1,030	—	—	2,121
Purchase obligation(3)	17,073	—	—	—	17,073
Total	$ 23,434	$ 1,030	$ —	$ —	$ 24,464

(1) In June 2017, we entered into the Revolving Loan. Amount reflects the contractually required principal and interest payments. See Note 6 to our consolidated financial statements included elsewhere in this prospectus.

(2) We lease our facility under a non-cancelable operating lease. In February 2015, we entered into a lease for our current laboratory and office space that commenced in May 2015 and expires in November 2020. The minimum lease payments above do not include any related common area maintenance charges or real estate taxes. In November 2020, we may extend the lease at the then-current market rates.

(3) On November 22, 2017, we entered into a pricing agreement with Illumina to purchase certain consumables and equipment. As of December 31, 2018, in accordance with the contract, we had a purchase commitment of $17.1 million by June 30, 2019. On March 26, 2019, we entered into a new pricing agreement with this vendor, which replaced in its entirety the agreement dated November 22, 2017. The new pricing agreement has a commitment to purchase $1.7 million of equipment by June 30, 2019.

The contractual commitment amounts in the table above are associated with agreements that are enforceable and legally binding. Obligations under contracts that we can cancel without a significant penalty are not included in the table above.

We received $20.0 million in gross proceeds from the issuance of the Growth Capital Loan in March 2019, which is not included in the above table. Interest on the unpaid principal balance of the Growth Capital Loan accrues from the date of issuance, and compounds monthly at the effective rate of 15.23% per year.

The amounts in the table above do not include approximately $42.9 million and $44.3 million in customer deposits as of December 31, 2018 and March 31, 2019, respectively. These amounts included $37.3 million and $39.6 million from one customer as of December 31, 2018 and March 31, 2019, respectively, that we may be required to refund under certain circumstances. While customers have not historically required us to return prepaid amounts, if a customer that has prepaid us for future services cancels its contract with us or reduces the level of services that it expects to receive, we would generally be required to repay that customer's deposit with little or no notice. Because the requirement to return any deposits and the timing of any such repayments is uncertain, they have been excluded from the table above. If required to refund a deposit, we may not have the cash or other available resources to satisfy these repayment obligations. Even if we are able to satisfy the repayment obligation from available resources (including potentially a portion of the net proceeds of this offering), we may need to seek additional sources of capital to fund our operations which funding may not be available when needed or on acceptable terms. In either of those circumstances, our business, financial condition, results of operations, and reputation would be materially and adversely affected.

Quantitative and Qualitative Disclosures About Market Risk

Interest Rate Sensitivity

The market risk inherent in our financial instruments and in our financial position represents the potential loss arising from adverse changes in interest rates or exchange rates.

As of December 31, 2017 and 2018 and March 31, 2019, we had cash and cash equivalents of $22.6 million, $19.7 million and $33.2 million, respectively, consisting of cash held in bank accounts and money market funds denominated in U.S. dollars. A 100 basis point change in interest rates would not have a material effect on the fair market value of our cash and cash equivalents.

As of December 31, 2018, we are also exposed to market risk from changes in interest rates as a result of our indebtedness under the Revolving Loan, which matures on March 31, 2019. At December 31, 2017 and 2018, we had $5.0 million principal amount outstanding under the Revolving Loan. The interest rate associated with the Revolving Loan is the prime lending rate plus 6.75%. An immediate 100 basis point change in the prime interest rate would not result in a material impact on our results of operations for 2017 and 2018. See Note 6 to our consolidated financial statements for further description of the Revolving Loan.

We are also exposed to market risk from changes in interest rates as a result of our indebtedness under the Growth Capital Loan. At March 31, 2019, we had $20.0 million principal amount outstanding under the Growth Capital Loan. Borrowings under the Growth Capital Loan bear interest at a floating rate per annum equal to the prime rate plus 5.00% for borrowings up to $15.0 million and the prime rate plus 6.50% for borrowing greater than $15.0 million. An immediate 100 basis point change in the prime interest rate would not result in a material impact on our results of operations for the three months ended March 31, 2019. See Note 6 to our consolidated financial statements for further description of the Growth Capital Loan.

Foreign Currency Risk

The majority of our revenues is generated in the United States. As of December 31, 2017 and 2018 and March 31, 2018 and 2019, we had generated an insignificant amount of revenues denominated in foreign currencies. As we expand our presence in the international market, our results of operations and cash flows are expected to increasingly be subject to fluctuations due to changes in foreign currency exchange rates and may be adversely affected in the future due to changes in foreign exchange rates.

Critical Accounting Policies and Estimates

Our consolidated financial statements have been prepared in accordance with U.S. generally accepted accounting principles (“GAAP”). The preparation of these consolidated financial statements requires us to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the consolidated financial statements, as well as the reported expenses incurred during the reporting periods. Our estimates are based on our historical experience and on various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions. We believe that the accounting policies discussed below are critical to understanding our historical and future performance, as these policies relate to the more significant areas involving management’s judgments and estimates.

While our significant accounting policies are described in the notes to our consolidated financial statements, we believe that the following critical accounting policies are most important to understanding and evaluating our reported financial results.

Revenue Recognition

Adoption of ASC Topic 606, “Revenue from Contracts with Customers”

On January 1, 2017, we early adopted the new accounting standard ASC Topic 606 using the full retrospective method. Results for reporting periods beginning after January 1, 2017, are presented under ASC Topic 606. The impact of adopting ASC Topic 606 was not material on our consolidated financial statements.

Revenue Recognition

We generate our revenues from selling sequencing and data analysis services. We agree to provide services to our customers through a contract, which may be in the form of a combination of a signed agreement, statement of work and/or a purchase order.

Upon adoption of ASC Topic 606, we have evaluated the performance obligations contained in contracts with customers to determine whether any of the performance obligations are distinct, such that the customers can benefit from the obligations on their own, and whether the obligations can be separately identifiable from other obligations in the contract. For all of our contracts to date, the customer orders a specified quantity of a sequencing; therefore, the delivery of the ordered quantity per the purchase order is accounted for as one performance obligation. Our contracts include only one performance obligation—the delivery of the sequencing and data analysis services to the customer.

Fees for our sequencing and data analysis services are predominantly based on a fixed price per sample. The fixed prices identified in the arrangements only change if a pricing amendment is agreed with a customer. In limited cases we provide our customers a discount if samples received are above a certain volume are purchased. In such cases, the discount applies prospectively. We have analyzed such discounts if they represent a material right provided to a customer. We have concluded that such discounts do not represent a material right provided to a customer since they are not deemed to be incremental to the pricing offered to the customer, or are not enforceable options to acquire additional goods. As a result, these discounts do not constitute a material right and do not meet the definition of a separate performance obligation. We do not offer retrospective discounts or rebates. Accordingly, all of the transaction price, net of any discounts, is allocated to one performance obligation. Therefore, upon delivery of the services, there are no remaining performance obligations.

Contracts that contain multiple distinct performance obligations would require an allocation of the transaction price to each performance obligation based on a relative stand-alone selling price basis. Sometimes we deliver sequencing results in two or more batches; however, since the quantity delivered per batch of each individual test per sales order in these instances is in the same ratio as in the original sales order, allocating the transaction price on the a relative stand-alone selling price basis would have no impact on the revenue recognized in any period presented.

We recognize revenue when control of the promised services is transferred to our customers. Management applies judgment in evaluating when a customer obtains control of the promised service, which is when the sequencing and data analysis service results are delivered to customers, at an amount that reflects the consideration to which we expect to be entitled to in exchange for those services. Revenue is recorded net of sales or other transaction taxes collected from clients and remitted to taxing authorities.

A customer contract liability will arise when we have received payments from its customers in advance, but has not yet provided genome and exome sequencing and data analysis services to a customer and satisfied its performance obligations. We record a customer contract liability for performance obligations outstanding related to payments received in advance for customer deposits. We expect to satisfy these remaining performance obligations and recognize the related revenues upon providing sequencing and data analysis services.

All of our revenues and trade receivables are generated from contracts with customers and substantially all of our revenues are derived from U.S. domestic operations. The following section describes the accounting policies that we believe have significant judgment, or changes in judgment, as a result of adopting ASC Topic 606.

Payment Terms

Payment terms and conditions vary by contract and customer. Our standard payment terms are typically less than 90 days from the date of invoice. In instances where the timing of our revenue recognition differs from the

timing of its invoicing, we have determined that our contracts do not include a significant financing component. The primary purposes of our invoicing terms are to provide customers with simplified and predictable ways of purchasing our services and provide payment protection for us.

Redeemable Convertible Preferred Stock

We record all shares of redeemable convertible preferred stock at their respective fair values on the dates of issuance, net of issuance costs. In the event of our voluntary or involuntary, liquidation, dissolution, or winding up, or a liquidation event such as a merger, acquisition and sale of all or substantially all of our assets, each of which we refer to as a deemed liquidation event, proceeds will be distributed in accordance with the liquidation preferences set forth in the amended and restated certificate of incorporation unless the holders of redeemable convertible preferred stock have converted their redeemable convertible preferred shares into common stock. Therefore, the redeemable convertible preferred stock is classified outside of permanent equity on the consolidated balance sheets as events triggering the liquidation preferences are not solely within our control. We have not adjusted the carrying values of the redeemable convertible preferred stock to the liquidation preferences of such shares because it is uncertain whether or when an event would occur that would obligate us to pay the liquidation preferences to holders of shares of redeemable convertible preferred stock. Subsequent adjustments to the carrying values to the liquidation preferences will be made only when it becomes probable that such a liquidation event will occur.

Convertible Preferred Stock Warrants

We account for warrants to purchase shares of our redeemable convertible preferred stock as liabilities at their estimated fair value because these warrants may obligate us to transfer assets to the holders at a future date upon a deemed liquidation event. The warrants are recorded at fair value upon issuance and are subject to remeasurement to fair value at each period end, with any fair value adjustments recognized in the consolidated statements of operations and comprehensive loss. We will continue to adjust the warrant liability for changes in fair value until the earlier of the exercise or expiration of the convertible preferred stock warrants, the completion of a deemed liquidation event, or the conversion of redeemable convertible preferred stock into common stock, or until holders of the redeemable convertible preferred stock can no longer trigger a deemed liquidation event. In connection with this offering, the convertible preferred stock warrants will be automatically converted into warrants to purchase shares of our common stock.

Common Stock Warrants

Our common stock warrants are classified as equity as they meet all criteria for equity classification. The common stock warrants are recorded at fair value upon issuance as additional paid-in-capital in the consolidated balance sheets. The common stock warrants are not remeasured after the issuance date. In connection with an initial public offering, the common stock warrants will remain outstanding unless voluntarily exercised by the holder.

Convertible Instruments

We evaluate and account for conversion options embedded in convertible instruments in accordance with ASC Topic 815, *Derivatives and Hedging Activities*. Applicable GAAP requires companies to bifurcate conversion options from their host instruments and account for them as freestanding derivative financial instruments according to certain criteria. The criteria include circumstances in which (a) the economic characteristics and risks of the embedded derivative instrument are not clearly and closely related to the economic characteristics and risks of the host contract, (b) the hybrid instrument that embodies both the embedded derivative instrument and the host contract is not remeasured at fair value under other GAAP with changes in fair value reported in earnings as they occur, and (c) a separate instrument with the same terms as the embedded derivative instrument would be considered a derivative instrument.

Stock-Based Compensation

We account for stock-based compensation arrangements with employees, using a fair value-based method, for costs related to all stock-based payments including stock options and stock awards. Our determination of the fair value of stock options on the date of grant utilizes the Black-Scholes option-pricing model.

The fair value of the option granted is recognized over the period during which an optionee is required to provide services in exchange for the option award, known as the requisite service period which usually is the vesting period, on a straight-line basis.

Estimating the fair value of equity-settled awards as of the grant date using valuation models, such as the Black-Scholes option-pricing model, is affected by assumptions regarding a number of complex variables. Changes in the assumptions can materially affect the fair value and ultimately how much stock-based compensation expense is recognized. These inputs are subjective and generally require significant analysis and judgment to develop.

- *Expected Term*—The expected term assumption represents the weighted-average period that the stock-based awards are expected to be outstanding. We have elected to use the "simplified method" for estimating the expected term of the options, whereby the expected term equals the arithmetic average of the vesting term and the original contractual term of the option.
- *Expected Volatility*—For all stock options granted to date, the volatility data was estimated based on a study of publicly traded industry peer companies. For purposes of identifying these peer companies, we considered the industry, stage of development, size, and financial leverage of potential comparable companies.
- *Expected Dividend*—The Black-Scholes option-pricing valuation model calls for a single expected dividend yield as an input. We currently have no history or expectation of paying cash dividends on its common stock.
- *Risk-Free Interest Rate*—The risk-free interest rate is based on the yield available on U.S. Treasury zero-coupon issues similar in duration to the expected term of the equity-settled award.

We estimated the fair value of the time-based employee stock options using the Black-Scholes option-pricing model based on the date of grant with the following assumptions:

Common Stock Valuations

The estimated fair value of the common stock underlying our stock options was determined at each grant date by our board of directors, with input from management. All options to purchase shares of our common stock are intended to be exercisable at a price per share not less than the per-share fair value of our common stock underlying those options on the date of grant.

In the absence of a public trading market for our common stock, on each grant date, we develop an estimate of the fair value of our common stock based on the information known to us on the date of grant, upon a review of any recent events and their potential impact on the estimated fair value per share of the common stock, and in part on input from an independent third-party valuation firm. As provided in Section 409A of the U.S. Internal Revenue Code of 1986, as amended (the "Code"), we generally rely on our valuations for up to twelve months unless we have experienced a material event that would have affected the estimated fair value per common share.

Our valuations of our common stock were determined in accordance with the guidelines outlined in the American Institute of Certified Public Accountants Practice Aid, *Valuation of Privately-Held-Company Equity Securities Issued as Compensation* (the "Practice Aid"). The methodology to determine the fair value of our common stock included estimating the fair value of the enterprise using the "backsolve" method, which estimates the fair value of our company by reference to the value and preferences of our last round of financing, as well as our capitalization.

The assumptions used to determine the estimated fair value of our common stock are based on numerous objective and subjective factors, combined with management's judgment, including external market conditions affecting the pharmaceutical and biotechnology industry and trends within the industry:

- our stage of development;
- the rights, preferences, and privileges of our redeemable convertible preferred stock relative to those of our common stock;
- the prices at which we sold shares of our redeemable convertible preferred stock;
- our financial condition and operating results, including our levels of available capital resources;
- the progress of our research and development efforts, our stage of development, and business strategy;
- equity market conditions affecting comparable public companies; and
- general U.S. market conditions and the lack of marketability of our common stock.

The Practice Aid identifies various available methods for allocating enterprise value across classes and series of capital stock to determine the estimated fair value of common stock at each valuation date. In accordance with the Practice Aid, we considered the following methods:

- *Income approach.* The income approach attempts to value an asset or security by estimating the present value of the future economic benefits it is expected to produce. These benefits can include earnings, cost savings, tax deductions, and disposition proceeds from the asset. An indication of value may be developed in this approach by discounting expected cash flows to their present value at a rate of return that incorporates the risk-free rate for the use of funds, the expected rate of inflation over the asset's holding period, and the risks associated with realizing the cash flows in the amounts and at the times projected. The discount rate selected is typically based on rates of return available from alternative investments of similar type and quality as of the valuation date. The most commonly employed income approach to valuation is the discounted cash flow analysis.
- *Market Approach.* The market approach attempts to value an asset or security by examining observable market values for similar assets or securities. Sales and offering prices for comparable assets are adjusted to reflect differences between the asset being valued and the comparable assets, such as, location, time and terms of sale, utility, and physical characteristics. When applied to the valuation of equity, the analysis may include consideration of the financial condition and operating performance of the company being valued relative to those of publicly traded companies or to those of companies acquired in a single transaction, which operate in the same or similar lines of business.
- *Cost Approach.* The cost approach to valuation is based upon the concept of replacement cost as an indicator of value and the notion that an investor would pay no more for an asset than what it would cost to replace the asset with one of equal utility. The cost approach estimates value based upon the estimated cost of replacing or reproducing the asset, less adjustments for physical deterioration and functional obsolescence, if relevant. When applied to an enterprise, a type of cost approach referred to as the Net Asset Method is sometimes employed. This method measures the value of equity as the sum of the values of its assets reduced by the sum of the values of its liabilities. The resulting equity is reflective of a 100% ownership interest in the business. This approach is frequently used in valuing holding companies.

Based on our early stage of development and other relevant factors, we considered all three approaches and have chosen to apply both income and market approaches in our analyses. We determined these approaches were the most appropriate methods for allocating our enterprise value to determine the estimated fair value of our common stock for valuations performed for periods as of December 31, 2018 or earlier. In determining the estimated fair value of our common stock, our board of directors also considered the fact that our stockholders could not freely trade our common stock in the public markets. Accordingly, we applied discounts to reflect the

lack of marketability of our common stock based on the weighted-average expected time to liquidity. The estimated fair value of our common stock at each grant date reflected a non-marketability discount partially based on the anticipated likelihood and timing of a future liquidity event.

Following the completion of this offering, our board of directors intends to determine the fair value of our common stock based on the closing quoted market price of our common stock on the date of grant.

Income Taxes

We account for income taxes under the asset and liability method. Deferred tax assets and liabilities are determined based on differences between the financial statement reporting and tax bases of assets and liabilities and net operating loss and credit carryforwards and are measured using the enacted tax rates and laws that will be in effect when such items are expected to reverse. Deferred income tax assets are reduced, as necessary, by a valuation allowance when management determines it is more likely than not that some or all of the tax benefits will not be realized.

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.

We have elected to account for the tax on Global Intangible Low-Taxed Income, enacted as part of the Tax Cuts and Jobs Act as a component of tax expense in the period in which the tax is incurred.

Off-Balance Sheet Arrangements

Since our inception, we have not engaged in any off-balance sheet arrangements, as defined in the rules and regulations of the Securities and Exchange Commission.

JOBS Act Accounting Election

We are an emerging growth company, as defined in the Jumpstart Our Business Startups Act (the "JOBS Act"). Under the JOBS Act, emerging growth companies can delay adopting new or revised accounting standards issued subsequent to the enactment of the JOBS Act until such time as those standards apply to private companies. We have irrevocably elected not to avail ourselves of this exemption from new or revised accounting standards, and therefore, we will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

Recent Accounting Pronouncements

See the sections titled "Summary of Significant Accounting Policies—Recent Accounting Pronouncements" and "—Recent Accounting Pronouncements Not Yet Adopted" in Note 2 to our consolidated financial statements for additional information.

BUSINESS

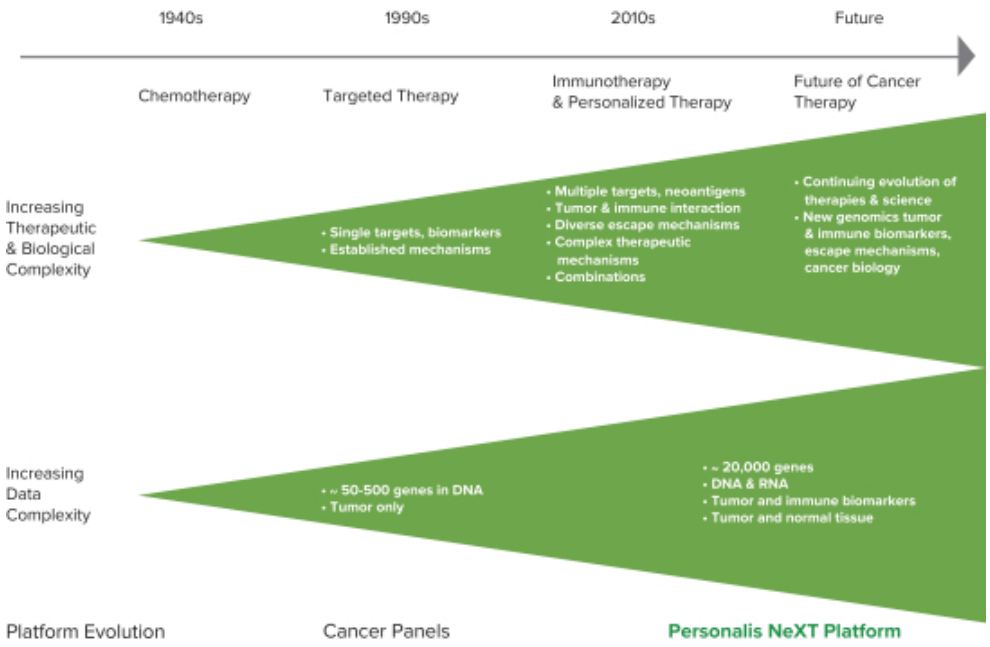
Overview

We are a growing cancer genomics company transforming the development of next-generation therapies by providing more comprehensive molecular data about each patient's cancer and immune response. We designed our NeXT Platform to adapt to the complex and evolving understanding of cancer, providing our biopharmaceutical customers with information on all of the approximately 20,000 human genes, together with the immune system, in contrast to many cancer panels that cover roughly 50 to 500 genes. We are also developing a complementary liquid biopsy assay that analyzes all human genes versus the more narrowly focused liquid biopsy assays that are currently available. By combining technological innovation, operational scale, and regulatory differentiation, our NeXT Platform is designed to help our customers obtain new insights into the mechanisms of response and resistance to therapy as well as new potential therapeutic targets. Our platform enhances the ability of biopharmaceutical companies to unlock the potential of conducting translational research in the clinic rather than with pre-clinical animal models or cancer cell lines. We are also planning to release a diagnostic based on our NeXT Platform that we envision being used initially by biopharmaceutical customers and clinical collaborators. Since inception, we have provided our services to more than 45 biopharmaceutical customers, including several of the largest pharmaceutical companies in the world.

In the past decade, the biopharmaceutical community has achieved major advances in the treatment of cancer, including approval of therapies capable of targeting specific genetic drivers of cancer and novel immunotherapies that empower the immune system to attack cancer cells. Despite these advances, the substantial majority of currently available cancer therapies have significant limitations, including efficacy only in certain subsets of patients, limited long-term survival rates, and significant toxicities. Moreover, the current research and development paradigm in oncology is beset by significant inefficiencies and substantial costs, with the average cost per patient in clinical trials reaching approximately $60,000. While tumor molecular profiling technologies have enhanced research and development efforts, most current tumor biopsy and liquid biopsy tests analyze a relatively narrow set of roughly 50 to 500 tumor genes, missing key genes and immune mechanisms underlying cancer therapy. With the lack of a comprehensive profiling solution, biopharmaceutical companies often attempt to use a disparate array of tests to compensate, resulting in a fragmented view of the tumor biology, insufficient tumor sample, logistical complexities, and increased costs. The resulting data heterogeneity makes it difficult to mine for new biological insights across cohorts of patients in clinical trials. These piecemeal approaches to tumor molecular profiling often result in solutions that are difficult to use at scale, especially in a clinical or therapeutic setting where simplicity, cost, turnaround time, and validation are important.

Our platform helps biopharmaceutical companies seeking to develop more efficacious therapies by comprehensively interrogating a patient's tumor and immune cells in detail, both to discover tumor vulnerabilities and elucidate potential therapeutic alternatives. To meet the demands of our customers, we built our NeXT Platform to be cost-effective and scalable with rapid turnaround times for tissue sample data and analytics. NeXT represents the next step of our existing ACE platform, allowing customers to move up the value chain by gaining more information from a single sample. We believe that our platform has the potential to enable a research, development, and treatment paradigm that is dynamic and adaptive to the evolving genomic and immune system landscape of patients' tumors over time. We believe our technology will drive this evolving paradigm, which will ultimately enable our customers to develop safer and more efficacious therapeutics (see Figure 1). As the clinical utility of our platform increases, we expect to grow our diagnostic capabilities, including the ability to guide therapy based on a patient's changing tumor and immune system, and supporting the commercialization of therapeutics developed by our biopharmaceutical customers.

Figure 1. Personalis NeXT Platform addresses the increasingly complex understanding of cancer.



Personalis: The Genomics Engine for Next-Generation Cancer Therapies

Biopharmaceutical customers use our comprehensive platform across a diverse set of therapeutic approaches to cancer. We generate and analyze data from patients who participated in clinical trials, which we believe will enable these customers to develop more effective therapies. These opportunities represent a significant end market that is much larger than our initial clinical-trial focused market, as the spending on cancer therapies and supportive care drugs for cancer increased to $133 billion globally in 2017.

The information we generate is important to our customers developing three major classes of next-generation therapeutics: immunotherapies, targeted therapies, and personalized cancer therapies. Based on the approximately 195,000 patients who are currently expected to enroll in the over 1,600 immunotherapy, targeted therapy, and personalized therapy clinical trials that commenced in 2018, we estimate the total addressable market for multiple time point comprehensive tissue and liquid biopsy testing in clinical trials is over $5.0 billion annually. See the section titled “Market, Industry, and Other Data” for additional information regarding the data, sources, and assumptions we used for this estimate.

- **Immunotherapies:** Over the past decade, a number of drugs have emerged based on the discovery that the immune system plays a key role in addressing cancer. Checkpoint inhibitors, a specific type of immunotherapy, generated worldwide sales of over $16.6 billion in 2018, up from approximately $1.4 billion in 2014. The commercial success of these drugs has shown the potential of immunotherapy; however, the development of new therapies in this category has been challenged by difficulties understanding the precise interaction between cancer and the immune system. The number of clinical trials in this space involving at least one cancer immunotherapy drug has grown from 123 that started in 2012 to 1,000 that started in 2018. Since our platform provides comprehensive insights on tumor and immune biology, we believe it will enable biopharmaceutical companies to better understand how therapeutics are working in patients.
- **Targeted Therapies:** A growing category of successful cancer treatments consists of therapies that target specific genes or molecular mechanisms of cancer. These drugs are not designed to influence the

immune system directly but the success of immunotherapies has brought acknowledgment that the immune system has a significant effect on their efficacy. Many of these targeted therapies are proposed to be tested in combination with immunotherapies. These therapies have grown to represent a considerable share of the overall oncology therapeutics market today. Comprehensively understanding each patient's genomic and immune profile is critical to understanding which of these therapies a patient may respond to. We believe that more comprehensive coverage of all of the approximately 20,000 genes positions us competitively against existing cancer panels that cover roughly 50 to 500 genes. We are positioning our company to be a leading provider of the complex information that we believe will continue to inform the development of targeted cancer therapies.

- **Personalized Cancer Therapies:** Many biopharmaceutical companies are pursuing personalized cancer therapies, which are designed and manufactured, individually, for each patient based on genomic alterations in a given patient's tumor. While there are many potential approaches to developing these therapies, including neoantigen-based vaccines and T-cell therapies, all of them can potentially benefit from the data and analytics that our platform can generate about a patient's tumor. Given the more than 700,000 cancer patients projected to be diagnosed with late-stage disease in the United States in 2019, we estimate that the total addressable market for our data and analytics for personalized cancer therapy could reach as much as $20 billion in the United States and as much as $40 billion worldwide. See the section titled "Market, Industry, and Other Data" for additional information regarding the data, sources, and assumptions we used for this estimate. Many of our customers have leveraged our U.S. Food and Drug Administration (the "FDA") Device Master File as a component of their investigational new drug ("IND") filings with the FDA. We anticipate that if drugs are approved that used our platform in the clinical trials forming the basis for approval, we may be able to derive revenue in connection with the sale of these drugs. We believe we are working with the majority of companies developing neoantigen-targeted personalized cancer therapies.

We anticipate that as the clinical utility of our platform is validated, we will have opportunities in connection with diagnostics and the commercialization of cancer therapeutics, which are significantly larger than our initial clinical-trial focused markets. Over time, we expect our biopharmaceutical customers and research collaborators to build evidence of clinical utility for our platform as a diagnostic for advanced cancer therapies. Separately, we are also acquiring samples and are building a database which will hold value for our biopharmaceutical customers and may ultimately allow us to discover new mechanisms of cancer treatment.

The NeXT Platform

Our NeXT Platform is designed to provide comprehensive analysis of both a tumor and its immune microenvironment, from a single limited tissue sample. Our platform covers the deoxyribonucleic acid ("DNA") sequence of all of the approximately 20,000 human genes. We also report on the entire transcriptome of a tumor, which encompasses ribonucleic acid ("RNA") expression across the approximately 20,000 human genes, allowing us to more accurately determine which of the many genomic mutations might actually be driving tumor progression. Furthermore, our platform analyzes elements of the immune cells that have infiltrated a tumor both from the adaptive immune system and the innate immune system.

Given the practical challenges in obtaining high-quality tumor samples via biopsy, we have developed our platform to work with a limited tumor tissue sample. Biopharmaceutical companies face significant challenges in attempting to divide samples to ship to multiple service providers to perform different tests. If a biopharmaceutical company is successful in acquiring results from multiple service providers, it is challenging to compare the results across multiple data platforms from multiple service providers. Our sequencing approach, validated with orthogonal technologies, allows us to run multiple analyses on a single sample. Our platform is composed of multiple proprietary technologies, many of which we have developed from the ground up. The breadth of the assays that we have integrated into our platform, our proprietary sample preparation process, and the comprehensiveness of our platform allow us to maximize the utility of often limited tumor tissue samples that our customers have from their clinical trials.

We have also shown that our technology can analyze cell-free DNA ("cfDNA") obtained from blood plasma, also known as a liquid biopsy. As with a tissue biopsy, we plan to analyze all of the approximately 20,000 human genes in each plasma sample, in contrast to currently marketed liquid biopsy panels. We are not aware of any other company that has publicly announced that they are developing a cell-free DNA ("cfDNA") platform that analyzes all of the approximately 20,000 human genes. We expect this cfDNA to be obtained by a blood draw concurrently with a tissue sample. Together, the two samples can be used to provide a more comprehensive initial characterization of the tumor. Additionally, we expect to monitor changes in tumor genetics that arise in response to therapy through serial measurements using cfDNA samples collected across multiple time points. In 2020, we plan to launch our first liquid biopsy assay designed to analyze all human genes so as to detect potential neoantigens and tumor escape mechanisms that arise under therapeutic pressure. Although we believe our cfDNA test will offer new insights, we believe it will be most useful for our biopharmaceutical customers alongside our primary tumor biopsy product, given that a tumor biopsy is required to analyze gene expression and elucidate tumor-infiltrating lymphocytes which are critical to understanding cancer's interaction with the immune system.

Our NeXT Platform was announced in late 2018, and the first revenues from this platform are expected in 2019.

Robust Operational Infrastructure to Scale with Our Customers

We have invested significant resources to develop an operational infrastructure that allows us to easily customize our services for each of our customers and scale rapidly to meet their potential research and commercial demands. Our NeXT Platform is complemented by our enterprise-grade software and bespoke information management systems that we tailor to meet our customers' unique needs and integrate with their workflows. Moreover, our infrastructure provides customers with visibility and control over processes, ensures consistency across all components used for the duration of each clinical trial, is traceable for compliance purposes, and allows us to scale while maintaining rapid turnaround times.

We designed our proprietary informatics system, the Symphony Enterprise Informatics System ("Symphony"), as a flexible and scalable enterprise-grade system used to manage the unique complexities and challenges of our genomics laboratory. Symphony integrates laboratory information management systems ("LIMS") and bioinformatics systems to connect laboratory operations with downstream data analysis. Symphony orchestrates all operational activities from our laboratory starting with sample receipt to the reporting of results of the genomic profiling and data delivery. We also use machine learning and artificial intelligence approaches to generate substantial performance advantages for our algorithms, such as neoantigen binding prediction.

We are sequencing and analyzing up to 100 trillion bases of DNA per week in our facility. We believe this capacity is already larger than most cancer genomics companies and we are building the automation and other infrastructure to scale further as demand increases and in support of the planned 2020 launch of our NeXT liquid biopsy assay.

Since 2012, we have been contracted to provide DNA sequencing and data analysis services to the United States Veterans Administration's (the "VA") Million Veteran Program (the "VA MVP"). The VA MVP began collecting samples in 2011 and is a landmark research effort aimed at better understanding how genetic variations affect health. Up to a million veterans are expected to enroll in the VA MVP study by 2021. With approximately 750,000 enrollees to date, the VA MVP exceeds the enrollment numbers of any single VA study or research program in the past, and is in fact one of the largest research cohorts of its kind. In September 2017, we entered into a one-year contract with three one-year renewal option periods with the VA for the VA MVP, and received orders under this contract in September 2017 and 2018. We are currently contracted to deliver approximately 80,000 genome sequence data sets to the VA MVP, and we expect revenue from the contracts awarded to date to continue into 2021. This relationship with the VA MVP has enabled us to scale our operational infrastructure and

achieve greater efficiencies in our lab. It has also supported our development of industry-leading, large-scale cancer genomic testing. The substantial experience that we have and expect to continue to develop in whole genome sequencing also optimally positions us for what we anticipate to be the longer-term strategic direction of the cancer genomics industry, which may include whole genome sequencing of tumors.

We believe our platform is well positioned to scale rapidly and substantially as the field of personalized cancer therapies matures. We believe that our platform could be essential to the composition and manufacture of any personalized cancer therapy developed using our platform. Furthermore, we expect that patients would be tested at multiple time points during the course of treatment: first to design a therapy according to an initial genomic profile generated from a tissue and/or liquid biopsy, and then as follow-up testing via liquid biopsy to detect any changes that would require therapy modifications after initial therapeutic interventions. If a therapy that uses our NeXT Platform achieves regulatory approval, we believe that our commercial opportunity may increase substantially.

Personalis is Valuable to Biopharmaceutical Companies

We believe that our platform is valuable to our customers because:

- **Our tumor and immune molecular profiling capabilities provide an unprecedented breadth of data from a single limited tumor sample.** We provide information on all of the approximately 20,000 human genes, as well as gene expression, the immune system, and other elements of cancer biology, in contrast to other currently marketed panels that cover a limited range of roughly 50 to 500 genes and do not focus on immune cells. The commercial success of immunotherapy drugs has demonstrated the need to better understand the immune system. Unfortunately, development of new therapies in this category has been challenged by difficulties understanding the precise interaction between cancer and the immune system. Since our platform provides comprehensive insights on tumor and immune biology, including in both innate and adaptive immune cells, we believe it will enable drug companies to better understand the biological effect of therapeutics in patients.
- **Our platform enhances the opportunity to conduct translational research by analyzing tumor tissues from patients in clinical trials, rather than animal models or in vitro cancer cell lines, which have historically limited cancer research.** While conventional pre-clinical model systems, such as animal models and cancer cell lines, have been instrumental in early-stage cancer research and drug development, translation of results to the clinic has been limited and remains a significant barrier to progress, in part because these models do not sufficiently reflect the complexity of human cancer and the human immune system. Over recent years, tools used to study tissue from patients have improved and the utilization of tissue from trials has increased. We believe our platform represents the next step in this transition by further enabling biopharmaceutical companies to address the historical limitations of analyzing patient tissue comprehensively.
- **The information we provide to personalized cancer therapy companies is used to design therapeutics.** Many biopharmaceutical companies are pursuing personalized cancer therapies, which are designed and manufactured, individually, for each patient based on genomic alterations in a given patient's tumor. While there are many potential approaches towards developing these therapies including neoantigen therapeutics, peptide-based vaccines, RNA and DNA vaccines, virally or bacterially encoded vaccines, and adoptive cell therapies, all of them benefit from the data and analytics that our platform can generate about a patient's tumor. We anticipate that drugs approved based on these therapeutic strategies may specify the use of our platform, enabling us to derive revenue in connection with the sale of commercial drugs, including the data generation and information processing required to treat each patient. We believe we are working with the majority of companies developing neoantigen-targeted personalized cancer therapies.
- **Our enterprise-grade operational infrastructure is scalable, enables rapid turnaround times, and is tailored to meet the unique workflow needs of our customers.** We have invested significant

resources to develop an operational infrastructure that allows us to easily customize our services for each of our customers and scale rapidly to meet their potential research and commercial demands. Moreover, our infrastructure provides customers with visibility and control over processes, ensures consistency across all components used for the duration of each clinical trial, is fully traceable for compliance purposes, and allows us to scale while maintaining rapid turnaround times.

- **We are developing a complementary liquid biopsy test, which also offers broad 20,000-gene coverage versus more narrowly focused liquid biopsy tests that are currently available.** We have also shown that our technology can analyze DNA obtained from blood plasma, also known as a liquid biopsy. As with a tissue biopsy, we analyze all of the approximately 20,000 human genes. We are not aware of any other company developing a cfDNA platform that analyzes all of the approximately 20,000 human genes. We expect this cfDNA to be obtained by a blood draw concurrently with a tissue sample. Together, the two samples can be used to provide a more comprehensive initial characterization of the tumor. Additionally, we expect to monitor changes in tumor genetics that arise in response to therapy through serial measurements using cfDNA samples collected across multiple time points. In 2020, we plan to launch our first liquid biopsy assay designed to monitor known neoantigens and detect novel neoantigens and tumor escape mechanisms that arise under therapeutic pressure.

Our Strategy

Our mission is to transform the development of next-generation cancer therapies by providing more comprehensive molecular data about each patient's tumor. To achieve this mission, our strategy is to:

- **Drive adoption of our platform by establishing and expanding relationships with leading developers of oncology therapeutics.** We believe that we can address the leading companies in oncology therapeutics with a small team of sales representatives and highly targeted marketing efforts. We augment this team with Ph.D.-level Field Application Specialists that provide deep understanding and expertise in the areas of oncology and genomics applications, allowing us to develop sciences-based dialog with our customers who are conducting clinical trials in many parts of their organizations. Once we have completed pilot studies with these customers, we work to expand our footprint by partnering with them on additional clinical trials using the newest versions of our technology. For example, we have successfully utilized this strategy with one of our large biopharmaceutical customers, with our revenues from this customer growing from approximately $473,000 during fiscal year 2017 to approximately $2.3 million during the three months ended March 31, 2019. We plan to continue to enter into such partnerships and pursue a publication strategy that further demonstrates the utility of our platform.
- **Invest in new product innovations and enhancements to maintain our leading position.** We will continue to make investments in new products that enhance our platform and further our competitive advantages. As the breadth of data used in drug development and cancer treatment becomes more and more complex, we believe our biopharmaceutical customers will look to our platform as a complete solution to drive efficiency in research and development. In 2020 we expect to launch a liquid biopsy test, which also offers broad 20,000-gene coverage versus the more narrowly focused liquid biopsy tests that are currently available.
- **Continue to build a body of evidence demonstrating the utility of comprehensive genomic data.** We expect the actionable information that customers gain from our platform will increase demand for our services. We intend to align ourselves with our customers, enabling them to develop better cancer therapeutics, which in turn demonstrates the utility of our platform. We expect this supportive cycle to increase our penetration into pharmaceutical and biotechnology enterprises over time.
- **Continue to grow our relationship with the VA MVP.** In addition to providing a stable source of revenue, our relationship with the VA MVP has enabled us to innovate, scale our operational

infrastructure, and achieve greater efficiencies in our lab. The substantial experience that we have and expect to continue to develop in whole genome sequencing also optimally positions us for what we anticipate to be the longer-term strategic direction of the cancer genomics industry.

- **Leverage a growing body of evidence from our platform to develop a diagnostic.** It is estimated that over 70% of oncology therapeutics in development are classified as personalized medicines, which require specific diagnostic testing prior to administration. We see a growing long-term diagnostic opportunity for NeXT as a one-stop, universal tumor profiling test for cancer patients. We are planning to release a diagnostic based on our NeXT Platform that we envision being used with biopharmaceutical and clinical partners.
- **Build out a comprehensive tumor-genomics database**. We also see a growing long-term opportunity to generate rich databases of content across a large number of cancer patients. Most current diagnostic based databases built using cancer panels cover just a small fraction of genes and miss information about the immune system whereas our platform will provide comprehensive information. This database would serve as a valuable tool to discover new cancer biology, new biomarkers, and potential therapeutic targets. It may include integration with other sources of real-world data ("RWD"), such as electronic health records, which can generate real-world evidence ("RWE") that may be used to reduce risk in early discovery by helping to identify biomarkers of response, improve trial execution through external control arms, expand indications for therapy, reduce trial size, and improve trial design.

Our Team

We have assembled a multidisciplinary team of experienced industry leaders to drive continuous innovation. Scientific and operational excellence is a guiding principle for our employees. As we have grown to over 145 employees, we have invested not only in the technology to provide information of sufficient quality for clinical use, but also in the people to continuously innovate for the industry's growing and changing demands.

Our President and Chief Executive Officer, John West, co-founded our company in 2011 in conjunction with four Stanford professors, Euan Ashley, M.D., Ph.D., Atul Butte, M.D., Ph.D., Russ Altman, M.D., Ph.D., and Michael Snyder, Ph.D. More broadly, our executive officers and management team members have had previous experience at a variety of genomics, pharmaceuticals, biotechnology, diagnostics, data analytics, service, enterprise software, and technology companies including Agilent Technologies, Inc., Applied Biosystems Inc., ARMO Biosciences, Inc., Illumina, Inc., Informatica LLC, Ingenuity Systems, Inc., Lumentum Holdings Inc., Merck & Co., Inc., Molecular Dynamics, Inc., Natera, Inc., Novartis Pharmaceuticals Corp., Pacific Biosciences of California, Inc., RainDance Technologies, Inc., and Solexa, Ltd.

Financial Highlights

Our revenues have grown rapidly as our penetration of clinical trials in advanced oncology therapeutics has expanded, consistent with our reputation as a leader in the field. We generated revenues of $9.4 million, $37.8 million, and $14.1 million for the years ended December 31, 2017 and 2018 and the three months ended March 31, 2019, respectively. We also incurred net losses of $23.6 million, $19.9 million, and $5.7 million for the years ended December 31, 2017 and 2018 and the three months ended March 31, 2019, respectively.

As of March 31, 2019, we had $33.2 million of cash and cash equivalents, an increase of $11.4 million from March 31, 2018. Our revenues are primarily generated through sales of our services to biopharmaceutical companies and the VA MVP. Unlike diagnostic or therapeutic companies, we have not sought reimbursement through traditional healthcare payors. We have raised $89.6 million in preferred stock equity financing to date.

Our Industry

Despite the large sums invested in research and despite new treatments, cancer remains a major challenge for modern medicine and a source of high unmet medical need. According to a 2018 American Cancer Society

report, “Cancer Facts & Figures,” as of January 1, 2016, there were more than 15.5 million people in the United States who were suffering from cancer or who had previously suffered from cancer, and more than 1.7 million people were expected to be diagnosed with the disease in 2018. Cancer prevalence is increasing globally as well. The World Health Organization (the “WHO”) predicted in its September 2018 estimates on the global prevalence of cancer that there would be 18.1 million new cancer cases and nearly 10 million cancer deaths globally in 2018. According to the WHO, the total economic impact of healthcare expenditure and loss of productivity resulting from cancer worldwide was approximately $1.2 trillion in 2010.

Improving Cancer Treatment is Increasingly About Leveraging Molecular Data

Despite the rapid evolution of cancer therapies, the current research and development paradigm in oncology is beset by significant inefficiencies and costs. Cancer therapeutics have one of the lowest clinical trial success rates of all major diseases. According to a study of 7,455 drug development programs during 2006 to 2015, the overall likelihood of FDA approval from Phase I clinical trial for oncology developmental candidates was 5.1%. The majority of currently available cancer therapeutics have serious limitations, including efficacy only in certain subsets of patients, limited long-term survival rates, and significant toxicities. The mechanisms underlying the success or failure of clinical trials are often poorly understood. To develop more efficacious cancer treatments, the biopharmaceutical community is faced with multiple key questions for a given therapeutic approach:

- Why do some patients respond to treatment and others do not?
- What are the underlying mechanisms of treatment resistance?
- Are there additional therapeutic targets or alternative pathways that can improve outcomes?
- What therapeutic combinations can improve outcomes?
- Are there ways to increase patient response through personalized therapeutics?
- Are there ways to reduce toxicity?

There is a growing recognition that there is a tremendous amount of untapped molecular data that can be derived from analyzing tumors from large numbers of cancer patients, whether in cancer clinical trials or post-commercialization, that can help answer some of these seminal questions and accelerate therapeutic development. The threefold increase in probability of FDA approval from Phase I clinical trial for therapies with biomarkers across all diseases and therapeutic types provides an indication of the benefits of leveraging molecular data.

Current Tumor Molecular Profiling Solutions Have Not Kept Pace with New Cancer Therapies

Biopharmaceutical companies are increasingly turning to tumor molecular profiling across large cohorts of patients to generate the data needed to answer these questions. Unfortunately, current tumor molecular profiling methods have not kept pace with new therapy development and overlook crucial elements of our evolving understanding of cancer biology.

Current tumor molecular profiling falls short for new cancer immunotherapies

Most current tumor molecular profiling panels were designed with a focus on targeted therapies, which, along with chemotherapy, have been used for cancer treatment for the past several decades. Targeted therapies treat cancers based on the specific genomic alterations driving their growth. Some targeted therapies have been developed to target specific molecules that are overexpressed or mutated in cancer cells. Because targeted therapies focus on cancer driver genes, the vast majority of tumor molecular profiling panels today, whether tissue or liquid biopsy based, typically sequence the DNA of between 50 to 500 genes, just a small fraction of the approximately 20,000 human genes.

Recently, however, transformational new approaches to cancer therapy that have been developed to harness the patient's own immune system have changed the treatment paradigm and our understanding of cancer biology. These new immunotherapies have dramatically improved the treatment of certain tumors that have previously been difficult to treat. Among these new immunotherapies, checkpoint inhibitors of the CTLA-4 and PD-1/PD-L1 genes are particularly effective. These therapies help "take the brakes off" the immune system and elicit a stronger immune response against the tumor. Patients can also be treated by adoptive cell therapy, in which the patient's immune system is supplemented with cytotoxic cells that have been programmed to attack cells expressing specific antigens on their tumors. There are also new opportunities for personalized cancer therapies where a new therapeutic vaccine or cell therapy is developed for each patient. Despite early success, the majority of patients today still do not respond to immunotherapy, underscoring the importance of gathering data that can help biopharmaceutical companies understand factors governing response and resistance to therapy.

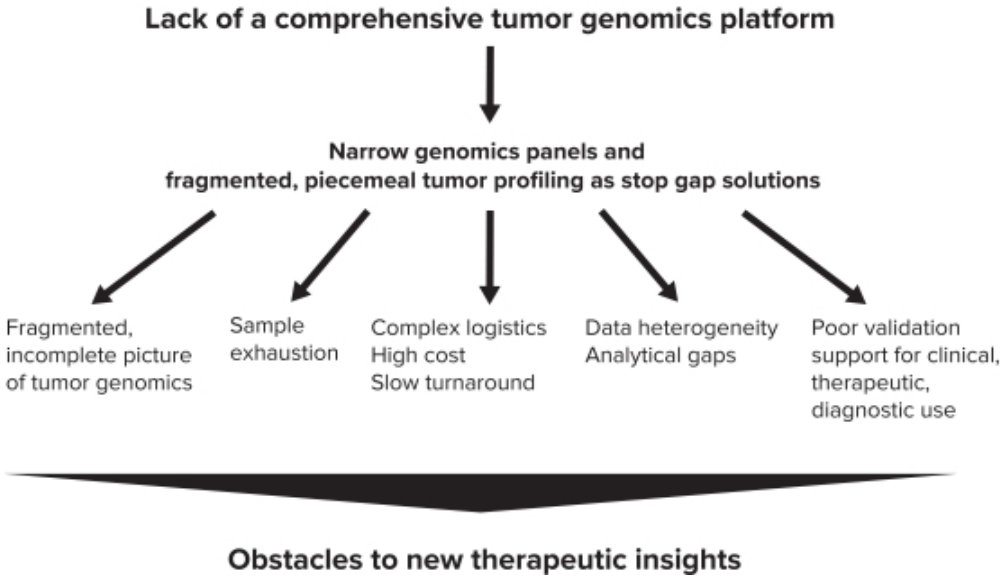
With these new immunotherapies and our rapidly evolving understanding of cancer biology, we believe the data needed to inform therapeutic development goes far beyond the typical 50 to 500 genes on current tumor molecular profiling panels. The paradigm has shifted from the need to understand mechanisms behind a single gene target to a dynamic, systems biology view involving complex interactions between thousands of genes in the tumor and the immune system in the pathogenesis of cancer and cancer drug response (see Figure 1).

Information about all of the approximately 20,000 human genes allows deeper insight into the biology of cancer, identifying novel or patient-specific therapeutic targets, including neoantigens, and predictive biomarkers of response to therapy. Understanding the immune cell signatures in the tumor microenvironment and immune repertoire changes is critical for understanding drug response. In addition to DNA, comprehensive RNA expression information from the tumor is needed to analyze complex pathways that may be activated in the tumor. It is important to identify the increasingly complex mechanisms of tumor response and resistance to cancer therapy, such as neoantigen burden, tumor antigens, deficient antigen presentation, oncogenic pathways, immune evasion pathways, HLA mutations, T-cell clonality, immune infiltration, and others. Table 1 describes some of the biological gaps in current panels. Most of these elements go beyond the capabilities of today's tumor molecular profiling panels.

Table 1. Most current tumor tissue and liquid biopsy profiling panels miss critical tumor and immune biology.

Key Gaps in Tumor Molecular Profiling Panels	Description
Too few genes sequenced, missed mutations	Most tumor molecular profiling panels (both tissue and liquid biopsy panels) focus on DNA sequencing of roughly 50 to 500 cancer driver genes, a fraction of the approximately 20,000 human genes that can harbor tumor mutations.
Lack of RNA coverage	RNA expression signatures are important biomarkers of therapy response.
No immune repertoire	The immune repertoire of the tumor helps in understanding responses to cancer therapies.
No germline genome	The normal ("germline") genome can contain pertinent information for understanding therapy response and providing a clear view of which mutations are only in the cancer.
Missed neoantigens	Neoantigens are tumor-specific antigens that can trigger an immune response against a tumor.
Missed tumor escape mechanisms, biomarkers	Tumor escape mechanisms may be critical to new immunotherapies and personalized therapies. This includes HLA mutations, MSI, TCR clonality, antigen processing machinery pathways, immune signatures, and other immuno-modulators.
Limited view of the innate immune system	Immune cell expression signatures are important biomarkers of therapy response.

Figure 2. Lack of a comprehensive tumor molecular profiling platform leads to major challenges for cancer therapy development.



Fragmented tumor molecular profiling approaches result in a fragmented view of biology and limited insights

With the lack of a comprehensive profiling solution, biopharmaceutical companies often turn to fragmented, piecemeal approaches to tumor molecular profiling as a stopgap measure (see Figure 2).

Those fragmented tumor molecular profiling approaches lead to major problems for therapeutic development. Limitations in available tumor samples, including liquid biopsies, force scientists to pick and choose which profiling platforms to include and which to omit, resulting in a fragmented picture of the biology. Fragmented profiling solutions also result in inconsistent profiling from patient to patient, and clinical trial to clinical trial. This results in data heterogeneity that makes it difficult to mine for new biological insights across cohorts of patients in trials. Finally, these piecemeal approaches to tumor molecular profiling result in solutions that often are difficult to use at scale in a clinical or therapeutic setting where logistical simplicity, cost, turnaround time, and validation are important.

Current tumor molecular profiling panels can become antiquated with evolving science

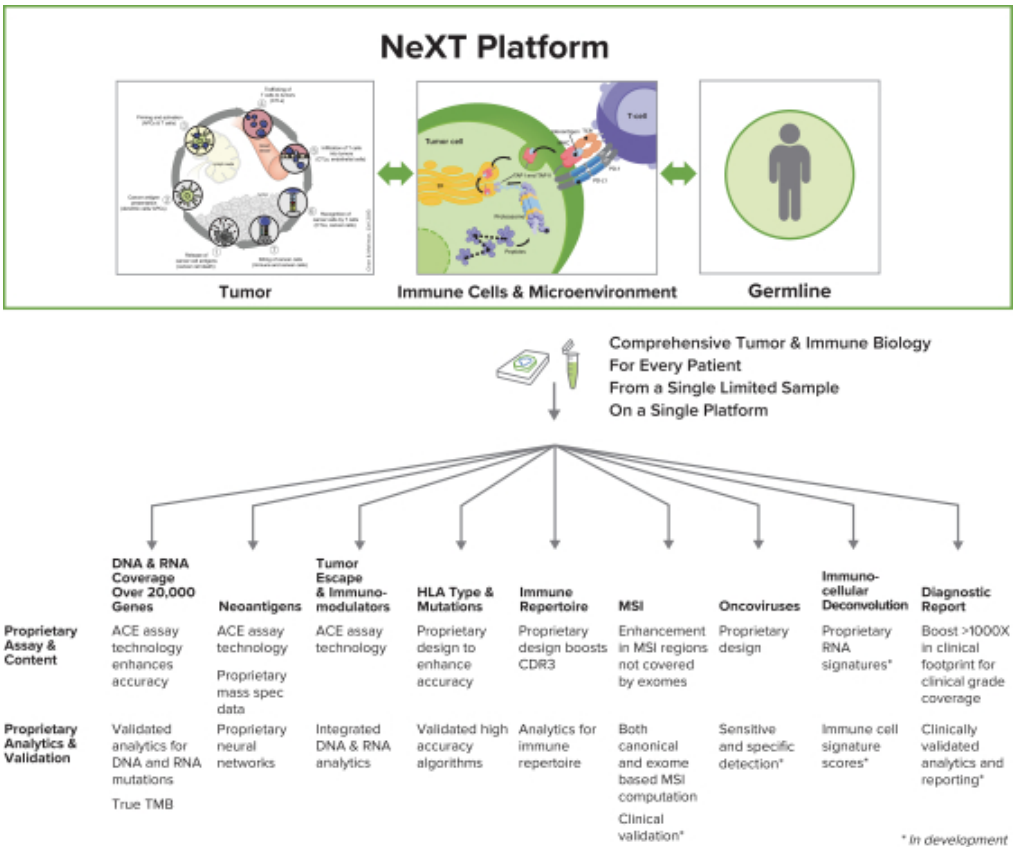
With the explosion of immunotherapy and advances in our understanding of cancer, new insights into the underlying mechanisms of response and resistance have emerged. New putative genetic or immune biomarkers of response are regularly identified for different therapies in the context of different cancers. For instance, new biomarkers have been identified including tumor mutational burden, neoantigens, HLA type, B2M mutations, TGFß, JAK1/JAK2 mutations, expression signatures, cytotoxicity signatures, and T-cell clonality, among others. A recent Nature Medicine review identified 18 different categories of biomarkers correlating with immunotherapy response spanning tumor, immune cells, and the tumor microenvironment. Due to the limited coverage of most cancer panels, they may miss new biomarkers. We believe this problem will continue as research uncovers new insights into cancer.

Our Platform: Advanced Tumor Molecular Profiling Built for the Future of Cancer Therapy

Our NeXT Platform ushers in a new paradigm for tumor molecular profiling by looking beyond the roughly 50 to 500 genes that limit current tumor profiling solutions. NeXT is designed to elucidate both the tumor genomics and its immune microenvironment simultaneously, representing a major step forward in tumor molecular profiling. Our platform interrogates all of the approximately 20,000 human genes in each tumor, generating more comprehensive molecular information than current profiling panels, from a single limited tumor sample. We have built NeXT to not only address the complex biology of new immunotherapies, but also to be broad enough to accommodate our rapidly evolving and increasingly complex understanding cancer. Finally, through technology innovation, we have made comprehensive tumor molecular profiling cost-efficient and scalable, enabling its use for large-scale profiling of cancer patients.

NeXT enables a paradigm where each cancer patient can benefit from comprehensive tumor molecular profiling, providing important data for cancer therapy development, personalized therapies, therapy selection, and diagnostics. Our platform enables biopharmaceutical customers to increase the insights generated from each tumor sample, reduce data heterogeneity, and simplify the process of tumor analysis. Our platform can be used to advance therapeutic development by elucidating diverse mechanisms of tumor escape, detecting neoantigens, identifying novel biomarker signatures, and characterizing the immune response.

Figure 3. The NeXT Platform generates the most comprehensive view of the tumor and immune biology today, all from a single limited sample.



NeXT Platform: Overview of Key Features & Differentiators

Comprehensive tumor and immune genomics from a single limited sample

- Sequencing and analyzing all of the approximately 20,000 human genes generates more comprehensive molecular information than current tumor tissue and liquid biopsy panels focused on roughly 50 to 500 genes
- Covers a much broader set of biomarkers for new immunotherapies and traditional targeted therapies
- Analysis of both tumor DNA and RNA expression
- Analysis of both tumor and normal tissue
- Analysis of non-human species such as oncoviruses (analytics in development)
- NeXT liquid biopsy, which we plan to launch in 2020, will target approximately 20,000 genes, enabling testing at multiple time points
- Proprietary technology enables superior sequencing quality and advanced analytics

Makes single, comprehensive tumor molecular profiling practical for cancer patients

- Tumor and immune molecular profiling from one limited tumor sample
- Engineered to be cost-effective and scalable, with rapid turnaround times, making it suitable for large-scale profiling of cancer patients
- Overcomes the need for fragmented tumor testing
- One platform for both research and clinical use

Platform anticipates future cancer biomarkers that will come with evolving science

- NeXT overcomes the limitations of small panels that become out of date when new genetic biomarkers or therapeutic targets are identified
- Comprehensive coverage of all genes, DNA and RNA, tumor and normal tissue, and immune biology enables our platform to accommodate new genetic biomarkers and signatures as they are published

Generates comprehensive, harmonized data across patients to enable large-scale database creation and insight

- Comprehensive profiling for large cohorts of patients leads to more useful databases for biopharmaceutical customers using our platform and our internal database
- Opportunity for integration with other sources of RWD such as electronic health records to generate RWE that may be used by biopharmaceutical customers to inform and accelerate therapeutic development
- Data harmonization, analytics, and machine learning maximize therapeutic insight
- Comprehensive nature of the platform provides long-lasting data relevance, yielding new insights over time as new biomarkers are identified

NeXT Platform: Advanced Tumor Molecular Profiling Built for Present and Future Cancer Therapies

To elucidate the complexity of tumor and immune biology, we have developed many new technologies that enable our platform to generate and analyze an order of magnitude more genomic data than most other cancer panels (see Figure 4). Our proprietary technologies and innovations span the entire NeXT Platform, including sample sparing preparation, advanced genomic sequencing, and new analytics with machine learning algorithms. We have also developed proprietary software and automation to integrate and scale the data, complex assays, analytics, and workflows underlying the platform (see Figure 5).

Figure 4. The order of magnitude increase in biological complexity, data size and analytical complexity has required innovation throughout the entire NeXT Platform.

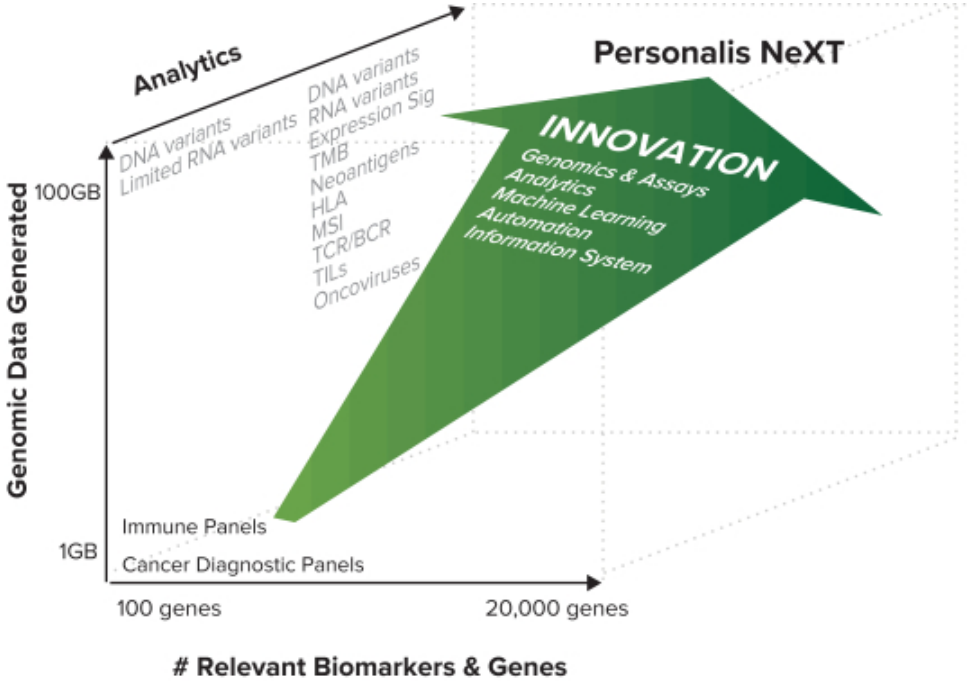
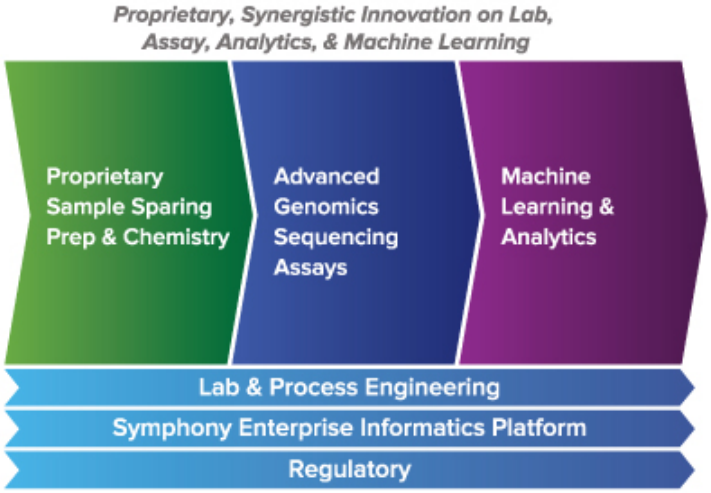
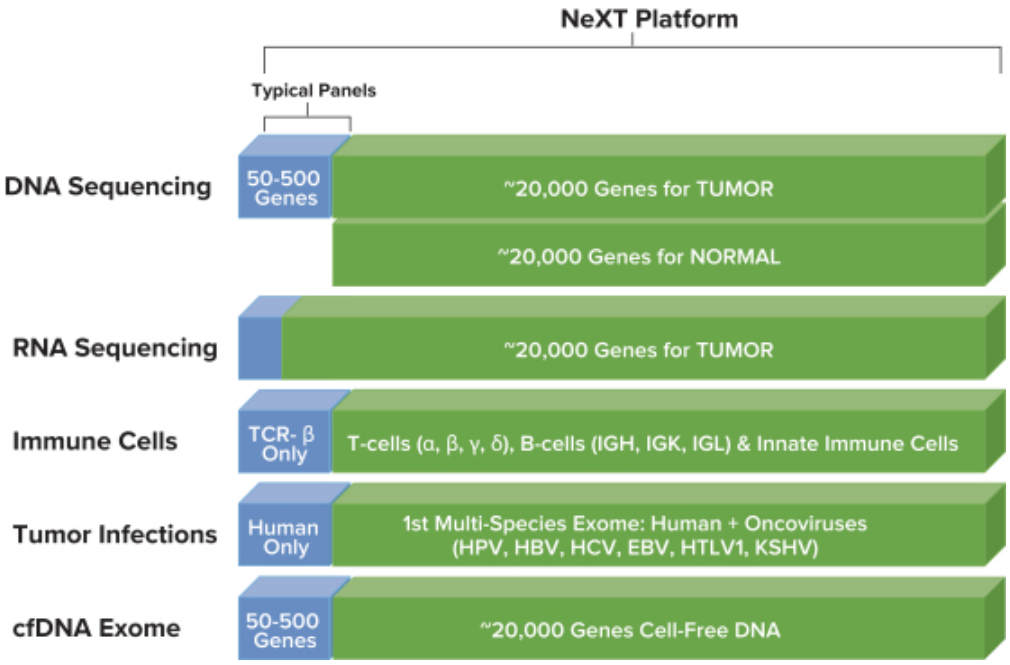


Figure 5: Areas of innovation across the NeXT Platform.



Through our technology innovation, proprietary methods, and intellectual property, our platform is capable of detecting mutations across all of the approximately 20,000 human genes in both DNA and RNA, immune repertoire for TCR a, ß, g, d and BCR l, k, immune signatures, diverse tumor escape mechanisms, and oncoviruses (in development). Compared to traditional cancer panels, our platform is broader in multiple dimensions.

Figure 6. NeXT generates broader biological insight than existing panel approaches.



Covers Biomarkers for Current and Future Therapies Through Broad Sequencing and Analysis of Approximately 20,000 Human Genes

Far beyond current cancer panels focused on roughly 50 to 500 genes, our platform sequences all of the approximately 20,000 human genes, enabling a broader view of tumor and immune genomics. Mutations of all types including single nucleotide variants, insertion-deletions, fusions, and copy number variations have been implicated in tumor resistance and response mechanisms for both targeted cancer therapies and immunotherapies, and thousands of these mutations can occur in each tumor. Our platform can identify crucial tumor and immune biomarkers, including in the tumor microenvironment, related biomarkers and critical alterations in the antigen presenting machinery, DNA repair and replication, immune checkpoint modulation, tumor associated antigens, immune response, microsatellite instability, cytokines and chemokines, and cytotoxicity.

Simultaneously Provides Both Tumor and Immune Insights, including T and B Cell Repertoire

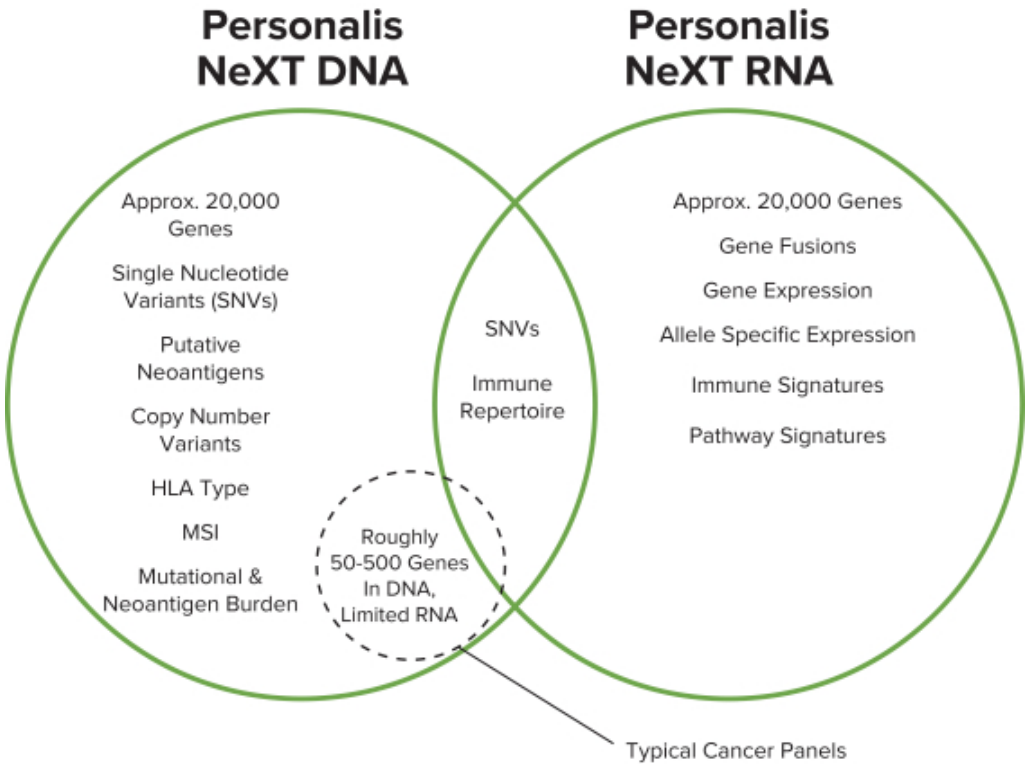
Simultaneously understanding both the tumor cells and the immune cells is critical for a deeper understanding of patient response to therapy. Unlike most cancer profiling panels that are focused on the tumor or immune repertoire alone, NeXT interrogates both the tumor and immune repertoire simultaneously. This is crucial as both the tumor and immune microenvironment can impact therapy response. Our platform sequences the broad immune repertoire including TCR a, b, g, d and BCR l, k from tumor FFPE (and fresh frozen) samples. The immune repertoire specific sequencing data derived from the NeXT assay is processed by our analytics, and a report is generated providing key metrics such as clonality, CDR3 nucleotide and amino acid

sequences, clonotype quantitation, distribution, and frequency, V, D, and J gene segments usage and overlap, and CDR3 nucleotide sequence length. These deliverables enable researchers to investigate the immune repertoire's potential as a predictive biomarker of response to immunotherapies and combination therapies.

Analyzes Both DNA and RNA for a Patient's Tumor

In contrast to most cancer diagnostic panels, the NeXT Platform sequences and analyzes both the DNA and RNA, which is extracted from the same limited sample. As shown in Figure 7, DNA and RNA sequencing data yields complementary insights into the tumor and immune genomics, providing a more complete view of tumor features that can impact cancer therapy. Furthermore, by simultaneously looking at both, there are new opportunities to combine information to improve analytical results for neoantigens and other advanced biomarkers, which can include multi-gene signatures.

Figure 7. DNA and RNA from our platform yield different but synergistic insights into the tumor and immune genomics.



Analyzing Both Tumor and Normal Tissue

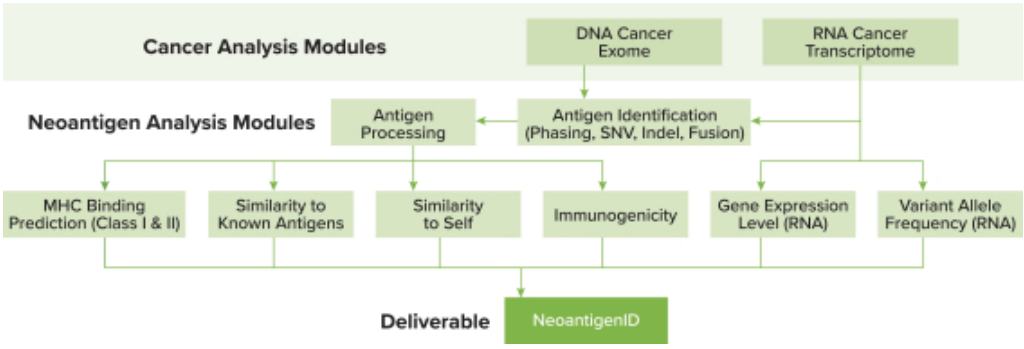
Most cancer panels do not sequence the genome of the patient's non-cancer tissue ("normal tissue"), which can contain pertinent information for understanding therapy response. By analyzing the normal tissue from the patient (typically blood samples), we improve the accuracy of identifying cancer specific mutations by using genetic variants found in the normal tissue as a reference point. Panels that do not utilize the normal tissue as a reference point can mistake germline mutations for cancer mutations. Furthermore, the normal tissue can yield additional genetic information that may be relevant to interpreting cancer therapy response. One example of this is HLA type, which has been correlated with response to immunotherapy. Germline mutations can also predispose patients to cancer.

Analysis of Neoantigens with Proprietary Assay Design and Machine Learning Algorithms

Neoantigens are derived from tumor-specific mutations that vary from patient to patient and can potentially trigger an immune response to the tumor. When neoantigens bind to and are presented on the major histocompatibility complex ("MHC") on cells, they can be recognized as "foreign" by the immune system and elicit an immune response to the tumor. Because of this, neoantigens have attracted strong biopharmaceutical interest as both a therapeutic target for personalized therapies and a biomarker for drug response. The predicted neoantigen burden in tumors has also been reported to be a biomarker of response of immunotherapies in certain cancers. Many neoantigens are missed by narrow cancer panels because they can arise from mutations in any of the approximately 20,000 human genes.

To enable these applications, we have developed proprietary methods to better identify and characterize neoantigens from a patient tumor sample. We have designed proprietary assay and algorithmic elements in NeXT including enhanced DNA and RNA sequencing technology, HLA typing, MHC-binding prediction, similarity-to-self, similarity-to-known antigens, and immunogenicity that are all used to improve detection and characterization of potential neoantigens.

Figure 8. Our neoantigen prediction engine combines proprietary assay design and proprietary analytics to identify and characterize neoantigens.



The MHC-binding prediction for each candidate neoantigen is a particularly critical step in the neoantigen characterization process. There are multiple variants ("alleles") of MHC proteins present in any individual and these alleles also vary between individuals. Each MHC variant has a unique set of peptides or neoantigens that it can present to the immune system. If an individual does not have an MHC allele that can bind to a particular neoantigen it will not be able to trigger an immune response to the tumor.

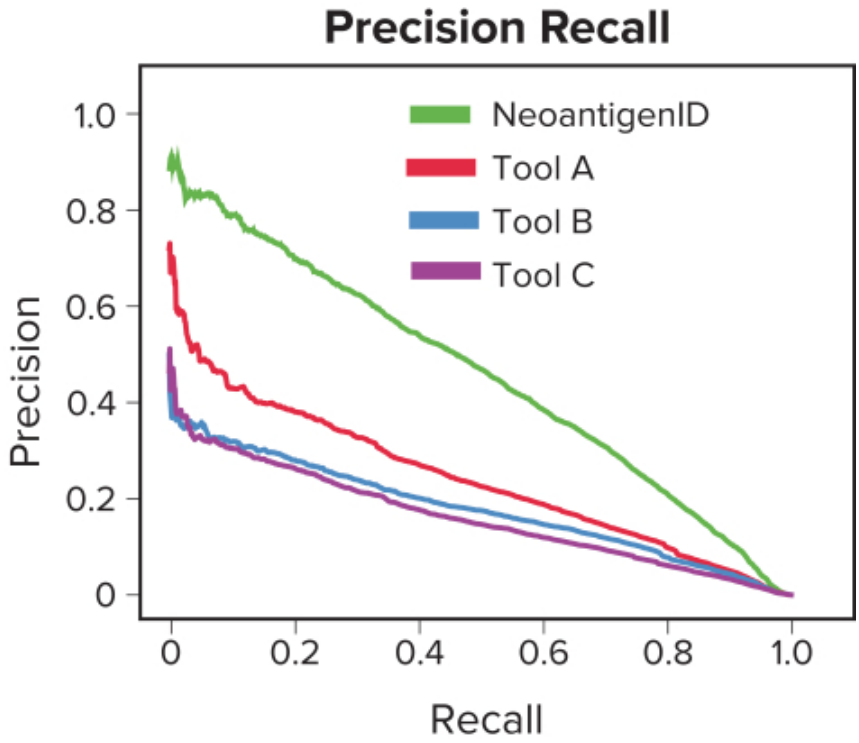
While academic groups have developed machine learning algorithms that can help predict the binding of peptides to individual MHC alleles, these algorithms were built upon data that was obtained from many different sources and was of limited quantity and varying quality. To address the limitations of existing tools, we have generated our own MHC binding data and used this high quality, systematically collected data as the basis for training our machine learning algorithms.

We have engineered proprietary cell lines that express only one MHC allele at a time and used a combination of chromatography and mass spectrometry to determine which peptides are bound to each allele. We believe we have one of the most comprehensive databases of peptide binding to specific MHCs of this type. We use this data and our computational tools to build proprietary peptide binding predictions that are individualized for each MHC allele.

As seen in Figure 9, our MHC neoantigen binding predictions perform more accurately than the best publicly available prediction tools. A good prediction algorithm should be able to accurately identify peptides

that are well known to bind to a specific MHC receptor. There are two ways to measure the power of a neoantigen prediction algorithm: the ability to accurately identify a given neoantigen as binding to a specific MHC, known as precision (which is a measure of how likely the predicted binding is to be correct, meaning true positives divided by true positives plus false positives), and the ability to find all known neoantigens that bind to that MHC, known as recall (which is a measure of how likely binders will be found, meaning true positives divided by true positives plus false negatives). We attribute the increased accuracy of our predictions to the high quality of the data we have generated, as well as our proprietary machine learning algorithms.

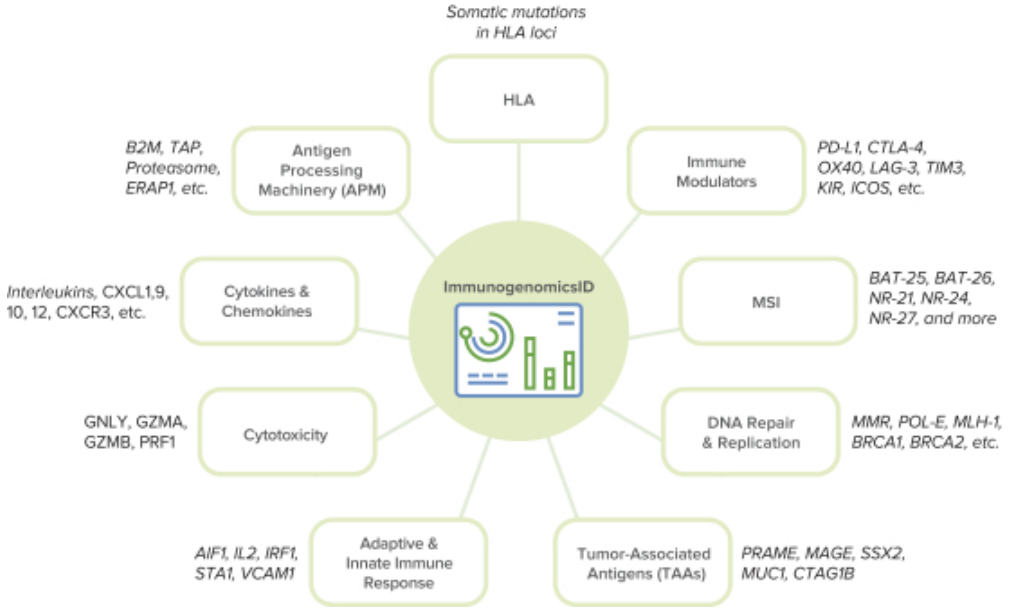
Figure 9. Predictive power of our MHC neoantigen binding method compared to standard methods.



Elucidating a Broad Set of Biomarkers Spanning Tumor and Immune Biology

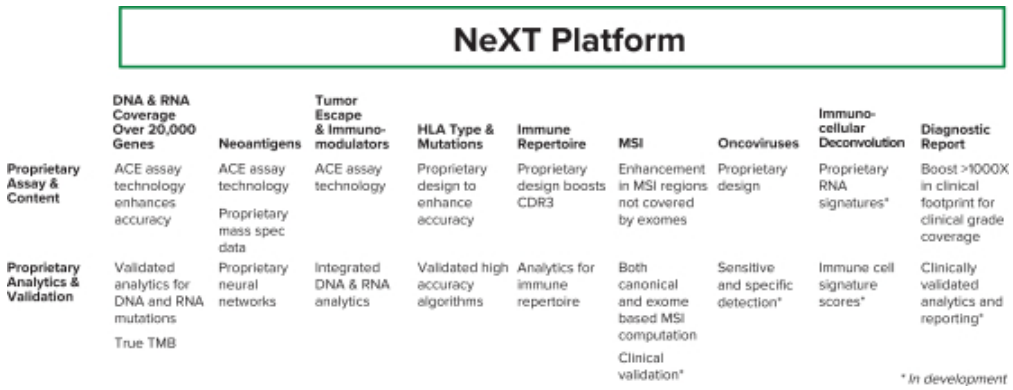
Since we offer a more comprehensive platform than others, we enable a broader analysis of key genomic biomarkers and signatures across multiple tumor and immune biomarker categories, such as neoantigens, HLA, immune modulator, DNA repair and replication, tumor-associated antigens, immune signatures, cytotoxicity, cytokines and chemokines, antigen processing machinery, and others (see Figure 10). Many of these biomarkers require both simultaneous assay and analytical technology development.

Figure 10. Broad biomarkers enabled by our platform give a comprehensive view of the biology.



In contrast to traditional approaches where assays are designed independently from the analytics, we have co-optimized our genomic assay design and analytics simultaneously to enable both unique analytical capabilities and enhanced performance for key biomarkers. Figure 11 summarizes some of the approaches we developed to achieve superior performance and comprehensiveness in our platform across a broad range of biomarkers:

Figure 11. Proprietary genomic assay and analytical innovations to enable NeXT.



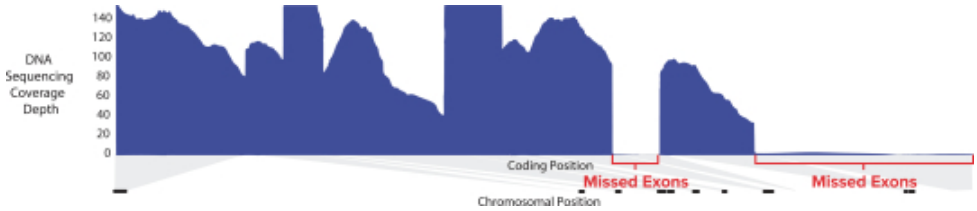
Superior Sequencing Quality and Coverage

Next generation sequencing ("NGS") is the technological basis for many tumor molecular profiling platforms today. NGS rapidly sequences nucleic acids and then uses a computationally intensive process to reconstruct gene sequences from millions of short sequence segments. These segments are processed in parallel, an approach that greatly increases the speed that the sequence data can be generated. However, because the segments come from random locations in the genome, reassembling the original sequence is both a technically

and computationally challenging process. A key objective is to ensure that every portion of the genes being sequenced is covered by at least one sequence segment. The average number of sequence segments representing a gene is referred to as the sequence depth. The deeper the coverage, the greater fraction of the gene is likely to be covered and the higher confidence that low-frequency variants can be found.

However, even when sequenced to high depth, typical NGS approaches can leave uneven, poor coverage in genes with mutations linked to cancer and cancer therapy. Many of these regions cannot be fully covered by simply sequencing to higher depth because their sequencing coverage deficits are due to inherent limitations of the NGS platform. Regions of high guanine-cytosine ("GC") content or repetitive sequence regions are two such examples of regions that are difficult to cover with standard NGS assays. This can leave gaps in coverage of therapeutically important genes (see Figure 12). This is particularly problematic in cancer, where there can be significant heterogeneity in the tumor samples that can make it even harder to see mutations in regions of poor coverage.

Figure 12. Coverage of SKT11 gene with standard NGS techniques leaves gaps in critical exonic regions.



To address the limitations of typical NGS-based assay, we have developed our patented Accuracy and Content Enhanced ("ACE") technology for next-generation sequencing. ACE improves nucleic acid preparation processes and combines it with patented assay and sequencing methods to achieve superior, high-fidelity, clinical-grade sequencing quality that ensures high sensitivity for mutations that can inform clinical and therapeutic applications such as neoantigen prediction, biomarker identification, and novel drug target selection.

Our NeXT Platform uses our ACE technology to provide coverage of difficult-to-sequence gene regions across all of the approximately 20,000 human genes, filling in key gaps left by other NGS approaches. ACE technology provides superior and uniform coverage of difficult genomic regions, such as high GC content areas, and fills gaps and inconsistencies in sequencing to achieve an optimal output (see Figure 13). ACE is able to deliver more comprehensive coverage not by simply generating more data, but by generating higher quality data. We and others have shown in two publications that our ACE technology achieves superior gene sequencing coverage and finishing (see Figure 14).

Figure 13. Coverage of SKT11 with our ACE sequencing process.

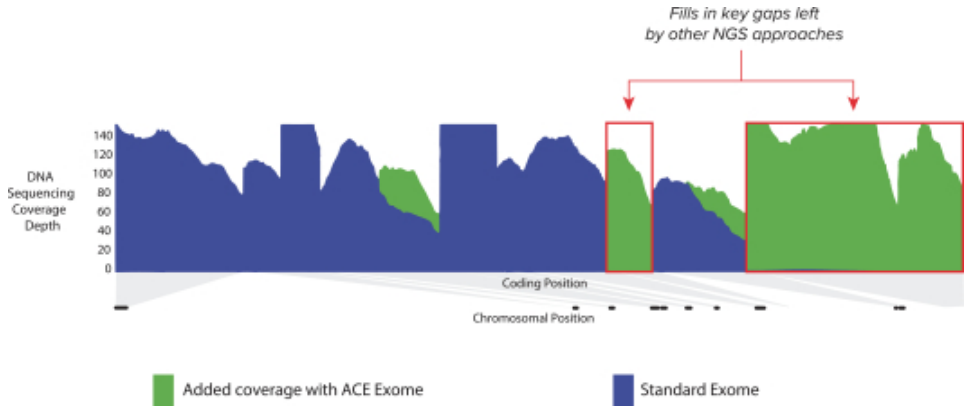
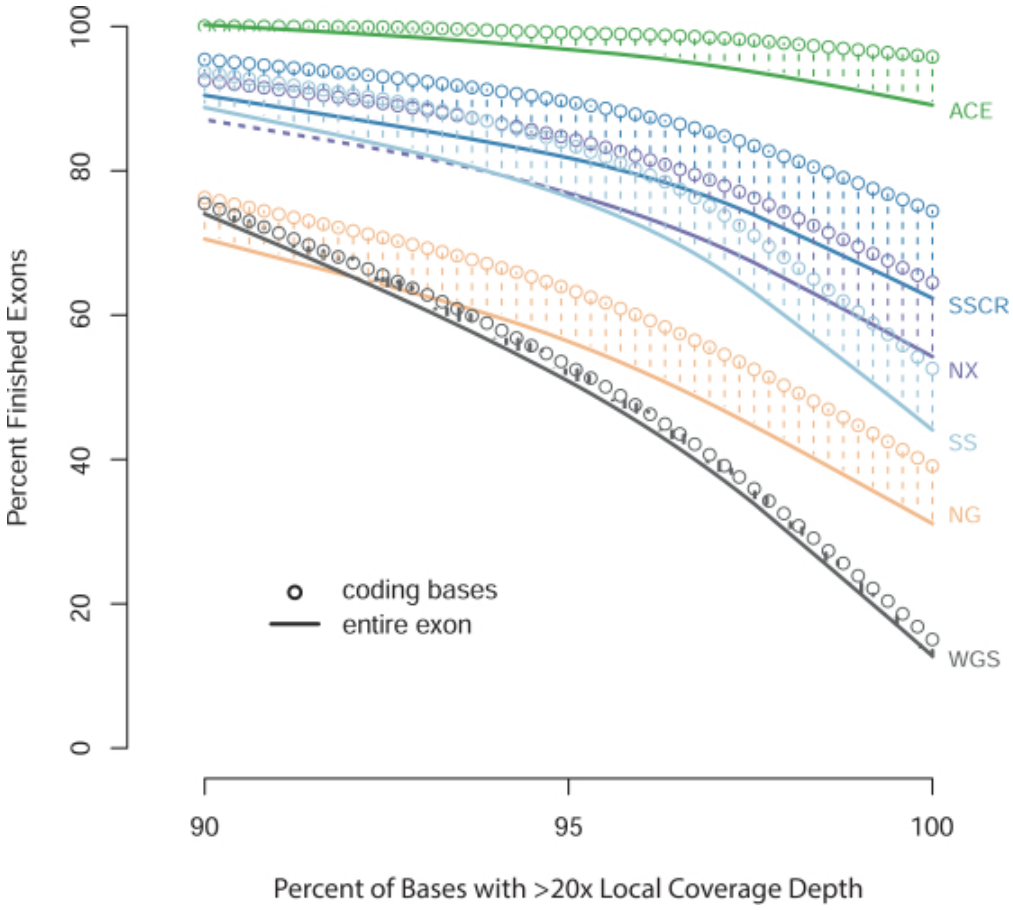


Figure 14. Personalis' ACE technology achieves superior sequencing coverage and gene finishing. (Patwardhan et al Genome Med. 2015)

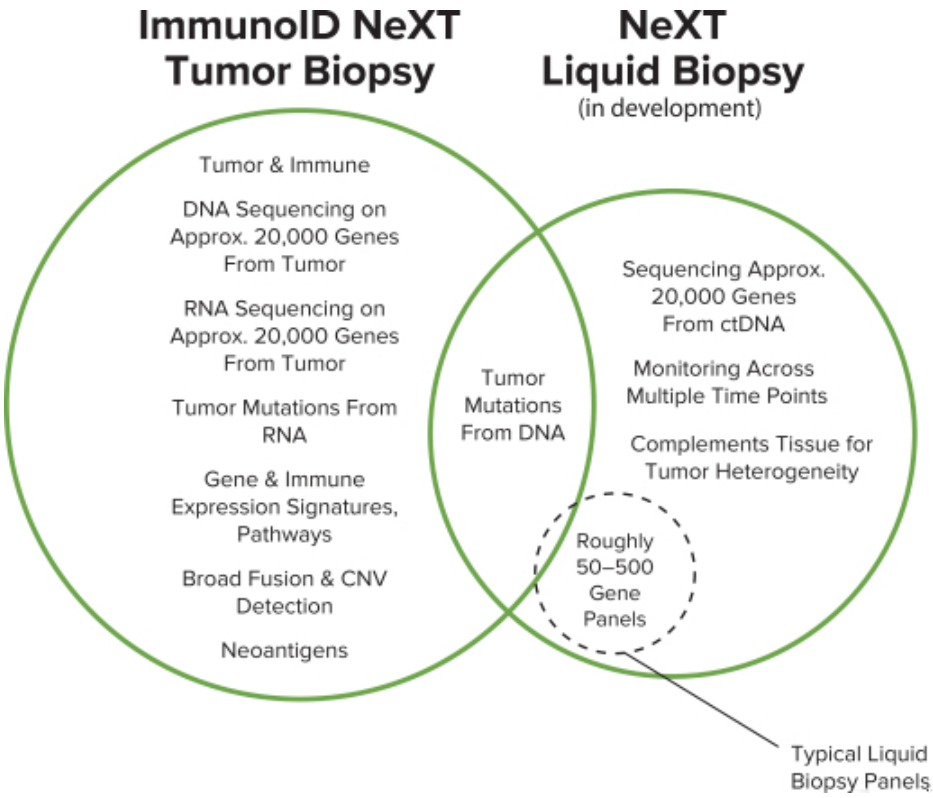


Liquid Biopsy Capabilities

Liquid biopsy approaches look at cfDNA in plasma samples derived from the blood. cfDNA is DNA that is released into circulation by cells, including tumor cells, as a result of cell death. This cfDNA can be obtained by a blood draw and can be used to monitor changes in tumor genetics.

We believe tumor biopsy and liquid biopsy approaches to tumor molecular profiling can provide complementary information for each patient. Tumor biopsies provide tumor immune microenvironment and tumor gene expression information that current liquid biopsy panels do not provide. Liquid biopsies can be useful for providing additional DNA mutation information, especially for monitoring therapy response across different time points when tumor biopsies are not feasible. Unlike typical liquid biopsy panel approaches focused on roughly 50 to 500 driver genes, we are designing our cfDNA approach, NeXT Liquid Biopsy, which is currently in development, to sequence all of the approximately 20,000 genes in the human genome. Our broader liquid biopsy approach will help biopharmaceutical customers identify biological changes across multiple time points for each patient in their trials that they would otherwise miss with the current, narrowly focused liquid biopsy panels. We also believe broader coverage will enable better neoantigen prediction, broader biomarker coverage, and higher potential to identify new drug targets.

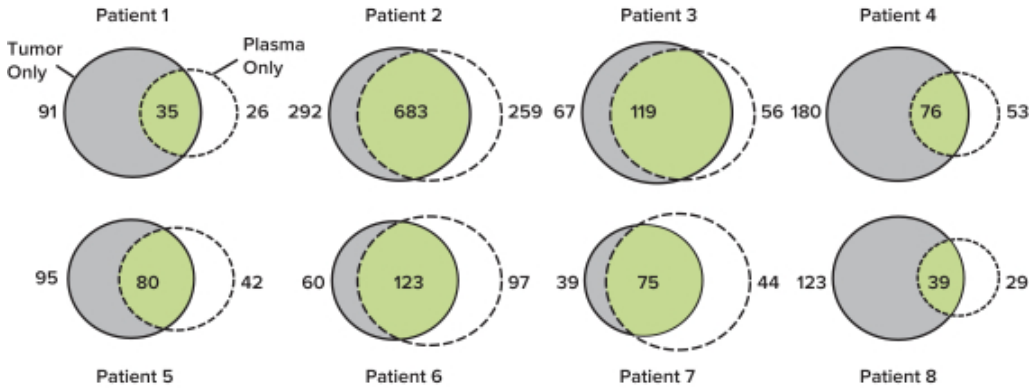
Figure 15: ImmunoID NeXT tumor biopsy and NeXT liquid biopsy (in development) yields complementary data.



We believe that combining tumor biopsies with cfDNA can provide a more complete picture of the spectrum of mutations found in a cancer patient. As an example of this, we compared the mutations found in eight late-stage colorectal tumor biopsy samples with those found in the plasma taken at the same time. We found a range of overlap between tumor biopsy-identified sequence variations and the sequences generated using

cfDNA. These observations show that, while there was significant overlap between the tumor and liquid biopsy results, there were also mutations unique to tumor biopsy and vice versa (see examples of this in Figure 16). This observation underscores the concept that tissue and liquid biopsies may be complementary, and when combined, may provide a more complete picture of the patient's disease.

Figure 16. Overlap of sequence variations detected in matched tumor and blood plasma.



Numbers indicate variants detected in the tumor only, plasma only, or in both.

We anticipate that our liquid biopsy approach will have many applications, including monitoring of tumor response to therapy over many time points, detecting new genetic variants from evolution of the tumor under therapeutic pressure, detecting acquired mechanisms of resistance, and identifying neoantigens.

NeXT makes comprehensive tumor molecular profiling practical for cancer patients at scale

To deliver a comprehensive immune-genomic assessment of a tumor, we invested substantial resources to engineer NeXT to provide data and analysis that would otherwise be unavailable or require many individual technologies, which collectively present significant costs and logistical impracticalities. With NeXT, we built a proprietary platform that is comprehensive, cost-effective, and scalable and enables a short turnaround time, making it practical to profile cancer patients at scale. This has required innovation on a number of fronts.

Comprehensive tumor and immune molecular profiling from a single limited tumor sample

The quality and quantity of tumor sample available for each patient is often very limited. We have developed proprietary techniques to overcome the challenges of working with these samples.

Tumor tissue biopsies, fine needle aspirates ("FNAs"), core biopsies, surgical resections, and blood specimens collected from cancer patients' samples are typically stored as fresh frozen ("FF") or formalin-fixed, paraffin-embedded ("FFPE") tissue. In both cases, there is typically limited tumor tissue available for molecular profiling. This can make it challenging, if not impossible, to achieve a comprehensive picture of the biology for each patient.

The quality of the tumor samples can also be a significant challenge. The best type of tumor sample for DNA and RNA sequencing and analysis is widely recognized to be FF biopsies. However, FF biopsies are not routinely collected because FFPE material is the specimen of choice for histopathological diagnosis. In almost every case, DNA extracted from FFPE specimens is degraded due to specimen processing, resulting in nucleic acid fragmentation, DNA crosslinks, random loss of nucleotide bases, localized DNA denaturation, strand breaks, and modification of bases leading to mutation artifacts which impede downstream sequencing analysis.

Conversely, FF samples are expensive to store and difficult to collect for large-scale studies. FFPE samples' quality issues exacerbate the issue of limited sample availability because when tissue is degraded, more of it is needed to generate sufficient sequencing data.

We have a simplified process using a dual simultaneous extraction of both DNA and RNA from challenging FFPE samples in a tissue-sparing manner. This allows us to use less tissue biopsy overall while preserving the quality of the extraction. When combined with our comprehensive assay, we are able to generate much more comprehensive data from a single limited sample than other platforms.

We have also developed techniques to overcome the challenges of working with difficult and degraded samples, including FFPE, FNAs, FF, PBMCs, and plasma. We are able to achieve high success rate with our customers. For prospectively collected FFPE samples with our personalized therapy partners, we achieve a greater than 95% success rate for obtaining high-quality data from tumor samples received from personalized cancer therapy customers due to our optimized nucleic acid extraction protocols.

Our proprietary software and operational infrastructure

We leverage Symphony, laboratory automation and protocols, and other technological improvements to power our NeXT Platform.

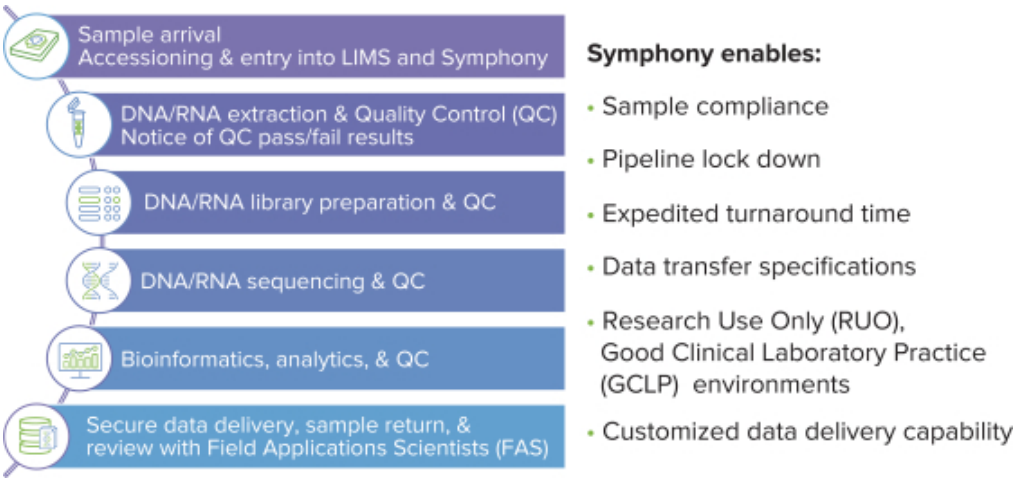
Symphony Enterprise Informatics Platform

Symphony is a flexible and scalable enterprise-grade system designed to manage the unique complexity and challenges of our large-scale genomics and analytics.

Symphony also integrates our LIMS and bioinformatics systems to connect laboratory operations with downstream data analysis. Symphony orchestrates all operational activities from the laboratory starting with sample receipt to the reporting of results of the tumor molecular profiling and data delivery. We developed Symphony to address the specific challenges associated with genomic data. Genomic data is unique in its size and complexity, even at the level of a single patient. The complexity is driven by data heterogeneity, such as DNA mutations, expression data, T-cell repertoire, and other sources, and the multifaceted workflows required to derive this data.

When scaled to the tens of thousands of samples per year, the complexity of genomic data grows and presents immense software engineering challenges. Since we did not identify any commercially available enterprise software system capable of addressing these challenges, we custom built Symphony from the ground up to address these specific challenges. In addition, Symphony manages multiple data and reporting streams with transparent versioning and traceability. This infrastructure allows us to meet the needs of all of our customers and provides a robust framework for future expansion as our customers anticipate clinical approval of their products.

Figure 17. Key customer benefits of Symphony.



Laboratory scale and automation

We have developed robust standard operating protocols and workflows that enable the accurate and efficient processing of samples from acquisition to data reporting. The combination of these standard protocols with dedicated staff and laboratory robotics has allowed us to develop an infrastructure that is designed to operate at scale. Our sequencing capacity has significantly increased each year since 2016, and we have an anticipated capacity of sequencing over 100,000 whole-genome length samples a year. Our high-performance computing infrastructure is capable of processing and storing the vast amount of data we generate with thousands of CPUs and petabytes of storage.

Enabling rapid turnaround time

Given the therapeutic and diagnostic applications of our platform, our customers require rapid turnaround times. The above technologies, which we have developed over years of engineering and optimization, allow us to achieve rapid turnaround times consistent with our customers' expectations, while also addressing the data complexity and achieving the level of comprehensiveness discussed above. For our personalized therapy partners, for example, we routinely deliver data and analytics in less than two weeks from sample receipt. Reductions in turnaround time have also required optimization of our laboratory processes. Our approach incorporates staffing of multiple shifts and over the weekends, so that each sample continues movement towards completion as rapidly as possible. We have purchased and installed highly parallel laboratory instruments, high-performance computing equipment, and multiple laboratory robots, developed laboratory workflow automation software, and invested in a significant multi-year research and development effort to integrate these pieces.

Delivering value to our customers

To deliver a comprehensive immuno-genomics assessment of a tumor, NeXT combines many elements that would previously have been individual assays, each with significant cost. These include a exome-scale sequencing assay that covers approximately 20,000 genes at high depth of sequence coverage, a transcriptome, a focused panel of cancer driver genes, a T-cell repertoire assay, a B-cell repertoire assay, an HLA typing assay, a microsatellite instability assay and several separate oncoviral assays. Although it has taken us several years to develop, optimize and validate, NeXT can now deliver all of these in a single platform, from a single sample. This is a major simplification of the testing process requiring fewer samples to be collected from each tumor. We offer NeXT at a cost that is competitive with tests that only address a single aspect of the spectrum of results NeXT delivers.

Breaking down the traditional separation between research and clinical platforms

Key parts of our platform have been analytically validated to support use in clinical trials, personalized therapies, and diagnostics.

We have actively differentiated our company and our services by building our ability to support our customers' regulatory filings, particularly with an eye toward personalized cancer therapeutics. In personalized cancer therapeutics, DNA sequencing and the associated data analysis are an integral part of each therapy and are a required element of the regulatory submission to obtain marketing approval. In addition to achieving CLIA licensing, CAP accreditation, and New York state certification for our laboratory over several years, starting in early 2017, we also began working with the FDA on filing a Device Master File. Our Device Master File is a document focused on the technology, quality management, and validation of our platform, specifically focused on its use for the development of personalized cancer therapies. This detailed information is not shared with our customers, but with our permission they can reference our FDA file number in their IND filings. We also provide support if the FDA has questions on our Device Master File. A growing number of clinical trials from a growing number of biopharmaceutical companies have been approved by the FDA that reference our Device Master File. To our knowledge, we are the only company with such a track record.

NeXT anticipates future cancer biomarkers that will be identified by rapidly evolving science

Existing narrow cancer panels can become outdated when new genetic biomarkers are identified. Given the rapid pace at which new cancer biomarkers and biology are being elucidated, this will continue to be a growing problem.

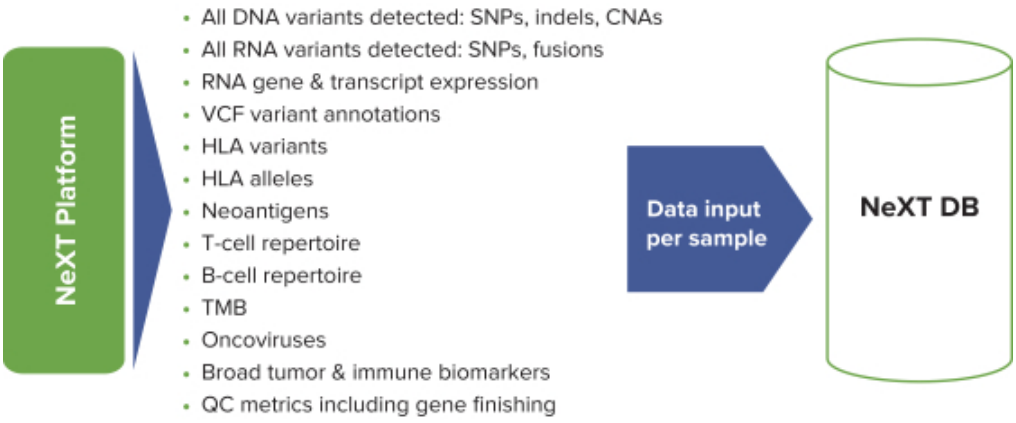
By covering all genes, DNA and RNA, tumor and normal tissue, tumor and immune biology, our platform can readily accommodate many of the new genetic biomarkers and signatures as they are published. This capability also allows the data generated from our platform to continue to yield new therapeutic insights even as our understanding of cancer and immune biology evolves. For example, just in the past few years, with immunotherapy, new tumor resistance biomarkers, such as HLA, JAK1/JAK2, B2M, and tumor mutational burden, and new gene expression signatures correlating with response have been published. By design, our platform already included these genes when the biomarkers were discovered.

NeXT generates comprehensive, harmonized data across patients to enable large-scale database creation and insight

As cancer therapy development becomes increasingly data driven, large databases aggregating information for many patients can be mined for new biomarkers and new potential therapeutic targets. By enabling comprehensive, harmonized data to be collected across large numbers of cancer patients, NeXT is setting the stage for new large-scale databases with unprecedented richness of tumor and immune data for each patient. Personalis is starting to build internal databases based on NeXT called NeXT DB (see Figure 18), as well as enabling our biopharmaceutical customers to build their own databases based on NeXT. With NeXT, we expect to solve many of the major challenges confronting biopharmaceutical companies trying to build these databases. In particular, our ability to solve the problem of data heterogeneity is important because it allows for more effective data mining and enables machine learning applications needed to analyze patient data within and across trials.

We also see a longer-term opportunity to enhance the value of a comprehensive tumor genomics database. This may include integration with other sources of RWD, such as electronic health records, which can generate RWE that may be used to reduce risk in early discovery by helping to identify biomarkers of response, improve trial execution through external control arms, expand indications for therapy, reduce trial size, and improve trial design. In December 2018, the FDA published a framework for evaluating RWD and RWE for use in regulatory decisions. This includes the potential use of RWD and RWE by biopharmaceutical companies to provide additional support for drug product effectiveness, serve as an external control for clinical trials, and provide data for observational studies.

Figure 18. Comprehensive genomic data for each sample can be structured and inputted into NeXT DB.



Our Platform Provides Value Across Many Therapeutic and Diagnostic Applications

We work closely with biopharmaceutical companies who are advancing new therapies in three major areas: immunotherapies, targeted therapies, and personalized cancer therapies. We have a critical role in generating new data and biological insights from patients in those clinical trials. We also see a long-term diagnostic opportunity for NeXT. Here, we describe some of the key products and applications of our platform.

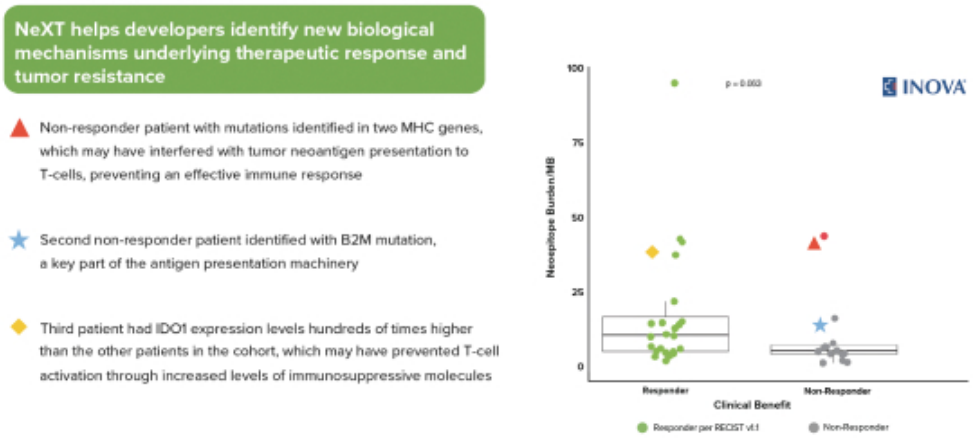
Cancer Immunotherapy Applications

Over the prior decade, a number of drugs have been approved by the FDA based on the discovery that the immune system plays a key role in fighting cancer. Checkpoint inhibitors, a specific type of immunotherapy, generated worldwide sales of over $16.6 billion in 2018, up from approximately $1.4 billion in 2014. Despite the medical and commercial success of these drugs showing the transformational potential of immunotherapy, the majority of patients do not respond to immune checkpoint inhibitors. The explosion in immunotherapy clinical trials across different immunotherapy modalities has also seen major challenges. The development of new therapies in this category is challenged by difficulties understanding the precise interaction between cancer and the immune system.

Our NeXT product is the newest version of our ImmunoID Platform aimed at immunotherapy development in translational research and clinical trials. NeXT enables immunotherapy translational and clinical researchers to comprehensively analyze both a tumor and its immune microenvironment from a single limited tissue sample. These samples are typically tumor tissue samples coming from patients enrolled in clinical trials. Our NeXT Platform can be used to investigate key areas of tumor biology, from elucidating mechanisms of tumor escape and detecting neoantigens, to identifying novel biomarker signatures and characterizing the immune repertoire. Since our platform provides comprehensive insights on tumor and immune biology, including in both innate and adaptive immune cells, we believe it will enable drug companies to identify biomarkers of response, mechanisms of resistance, and better understand how immunotherapies are working in patients.

Our collaboration with Inova Health System, a non-profit health organization based in Virginia, demonstrates how immunotherapy developers could use our platform to identify potential mechanisms of resistance. In this study, we applied our platform to generate profiles of the patients' tumors and to correlate those with the observed clinical responses. A cohort of the first 19 late-stage melanoma patients in this study were treated with anti-PD-1 checkpoint inhibitor immunotherapy. Consistent with prior research, the patients in our study with higher neoantigen burden were more likely to respond to checkpoint therapy, compared to those with lower neoantigen burden.

Figure 19. Neoantigen burden versus response to PD-1 checkpoint inhibitors in 19 late-stage melanoma patients and putative tumor escape mechanisms of outliers.



However, there were three outlier patients with high neoantigen burden whose response to checkpoint therapy was weaker than expected. Data from our platform helped provide putative mechanisms of tumor resistance. One patient had mutations in two MHC genes that may have caused this patient to be unable to properly present neoantigens found in the tumor to T-cells and thus prevented an effective immune response. A second non-responder patient had a mutation in the B2M gene which is a key part of the antigen presentation machinery. The third patient had expression levels of a gene called indoleamine 2,3-dioxygenase 1 ("IDO1") that were hundreds of times higher than the other patients in the cohort. The high levels of IDO1 in this patient may have therefore prevented T-cell activation through increased levels of these immunosuppressive molecules. This study highlights how this type of data can help immunotherapy developers identify new biological mechanisms that may be responsible for variable response to therapy.

We also believe our NeXT liquid biopsy (in development) has a strong application in biopharmaceutical clinical trials. With coverage of approximately 20,000 genes compared to smaller liquid biopsy panels focused on roughly 50 to 500 genes, we believe our liquid biopsy approach will allow our customers to see biological changes when monitoring tumor response to therapy.

Targeted Cancer Therapies Applications

Another growing category of successful cancer treatments consists of therapies that target specific genes or molecular mechanisms of cancer. These drugs are not designed to influence the immune system directly, but the success of immunotherapies has brought acknowledgment that the immune system has a significant effect on their efficacy. These therapies have grown to represent a considerable share of the overall oncology therapeutics market today. Much like for immunotherapy, our ImmunoID NeXT Platform helps targeted therapy developers better understand each patient's tumor and immune genomics more comprehensively, leading to insights that can help drive development of more successful therapies. We have customers developing solid tumor and hematological tumor-targeted therapies that are utilizing our platform as part of their drug development. We are positioning our company to be a leading provider of the detailed information that we believe will continue to drive targeted cancer therapy.

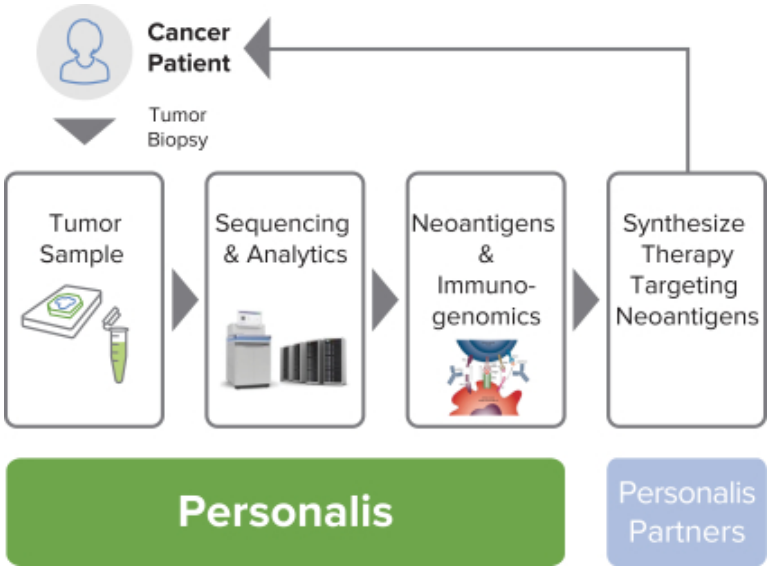
Personalized Cancer Therapy Applications

Many biopharmaceutical companies are pursuing personalized cancer therapies, which are designed and manufactured, individually, for each patient based on genomic alterations in a given patient's tumor. While there

are many potential approaches towards developing these therapies including neoantigen therapeutics, peptide-based vaccines, RNA and DNA vaccines, virally or bacterially encoded vaccines, and adoptive cell therapies, all of them benefit from the data and analytics that our platform can generate about a patient's tumor. Given the more than 700,000 cancer patients projected to be diagnosed with late-stage disease in the United States in 2019, we estimate that the total addressable market for our data and analytics for personalized cancer therapy could reach as much as $20 billion in the United States and as much as $40 billion worldwide. See the section titled "Market, Industry, and Other Data" for additional information regarding the data, sources, and assumptions we used for this estimate. Many of our customers have leveraged our FDA Device Master File as a component of their IND filings with the FDA. We anticipate that if drugs are approved whose design and clinical trials involved the use of our platform, we may be able to derive revenue in connection with the sale of these drugs, including the data generation and information processing required to treat each patient.

We believe we are working with the majority of companies developing neoantigen-targeted personalized cancer therapies. We work with companies developing both neoantigen-based personalized vaccines and personalized cell therapies for patients. Our platform serves as the genomics engine for many of these companies to generate comprehensive information required to identify potential neoantigens which can be used in personalized therapies. In addition, we generate other genomic information potentially useful in their therapy design process (see Figure 20).

Figure 20. Our platform is the genomics engine for the majority of personalized therapy companies today.



Our platform helps address key challenges for our personalized therapy partners:

- **The ability to identify more potential neoantigens.** With our platform, we use our proprietary technology to fill in sequencing gaps in genes so more neoantigens are detected. Furthermore we sequence approximately 20,000 genes to high depth in both DNA and RNA to increase sensitivity for mutations that can lead to neoantigens. We are also developing our NeXT liquid biopsy approach to identify additional and monitor existing neoantigens for personalized therapies.
- **The ability to better predict which putative neoantigens will trigger an immune response.** We have developed an analytical pipeline that helps identify putative neoantigens by synthesizing data from our platform. We also have developed proprietary mass spectrometry data and machine learning algorithms that improve accuracy of neoantigen-to-MHC binding prediction.

- **The ability to assess the MHC Class I and II HLA types for patients.** We have designed our assay specifically to augment HLA regions to enable high-accuracy HLA typing, a key input into the neoantigen prediction process for personalized therapies. This allows some of our customers to avoid separate HLA testing for each patient in their trial, simplifying logistics, and reducing turnaround time.
- **Broad characterization of other tumor immunogenomic modifiers that can impact patient response.** With our ImmungenomicsID report, we analyze both the DNA and RNA expression data for tumor and immune biomarkers that can inform the design of a personalized therapy.
- **High success rate on patient tumor samples.** With our proprietary methods and processes, we have been able to achieve a high success rate with samples from our personalized therapy customers. This is particularly critical for these clinical trials because if the tumor molecular profiling fails, these patients cannot receive the personalized therapy.
- **Rapid turnaround time.** The patients in clinical trials of these novel cancer therapeutics are often in the late-stages of disease. A therapy needs to be administered quickly to have the best chance of therapeutic benefit. This poses a challenge for personalized therapeutics. While a standard cancer therapy might be administered starting shortly after a patient is diagnosed, a personalized therapy will face a delay. This is the time required to obtain a sample from a patient, analyze the genetics of that individual tumor, and design, manufacture, and perform quality control on the therapy. Getting comprehensive tumor molecular profiling data from our platform is a key component of the overall time to personalized therapeutic delivery. With technology innovation, laboratory automation, and operational optimization, we have been able to achieve rapid turnaround time for our partners of less than two weeks in most cases, and for some in as few as seven days. Our ability to achieve rapid turnaround provides a large benefit to customers in this area.
- **Proactive approach with the FDA.** Because the area of personalized therapy is still being defined from a regulatory standpoint, we have taken a proactive approach to working with the FDA. To enable our partners in this space, we have filed a Device Master File with the FDA that our customers can refer to in their IND submissions. This document details the technology underlying our platform as well as the validation that has been performed.

Diagnostic Applications

Over time, we also expect to work with our biopharmaceutical customers and research collaborators to build evidence of clinical utility for our platform as a diagnostic for advanced cancer therapies. We see a growing long-term diagnostic opportunity for NeXT as a one-stop, universal tumor molecular profiling test for cancer patients covering all of the approximately 20,000 human genes compared to the roughly 50 to 500 genes covered by many currently marketed panels. We are planning to release a diagnostic based on our NeXT Platform that we envision being used with biopharmaceutical and clinical partners. This product analyzes FFPE tumor samples with our NeXT Platform and returns a CLIA diagnostic report for physicians that details the therapeutic options for patient-based on the tumor mutations identified from our analysis of the sample. We also see this product as one that will help us build our internal NeXT database over time. We estimate that the total addressable market in the United States and the European Union for oncology clinical diagnostic testing was $14.4 billion in 2018. See the section titled “Market, Industry, and Other Data” for additional information regarding the data, sources, and assumptions we used for this estimate.

Commercialization Strategy

We commercialize our products in the United States and Europe through our targeted sales organization. In 2018, we derived substantially all of our revenues from our customers in the United States. Our sales representatives have extensive experience in enterprise/consultative selling in the genomics space. We augment this team with Ph.D.-level Field Application Specialists that provide deep understanding and expertise in the areas of oncology and genomics applications, ensuring top-quality pre- and post-sales customer support. Our

commercial efforts are focused on demonstrating the value proposition of the NeXT Platform to biopharmaceutical customers with the goal of both increasing utilization of the product at existing accounts and to drive adoption in new targeted accounts. Our entire commercial organization promotes our ability to support biopharmaceutical customers across several application areas including biomarker discovery, new target discovery, therapy development, and treatment monitoring.

We anticipate that patients in clinical trials for cancer therapies will increasingly be tested pre-treatment and periodically afterwards to understand response to treatment in deep molecular detail, as their tumors evolve under therapeutic pressure. Although the majority of our revenues come from single time point testing, we believe our revenues from multiple time point testing will continue to grow. We also derive revenues from analysis of multiple customer samples from the same patient and time point to assess genetic differences between the primary tumor and metastases. Given the value of comprehensive genomic information from multiple time points or samples, we anticipate that our revenue, and the available market, will continue to grow.

As the clinical utility of advanced biomarkers is further established, we expect there to be a patient-centered diagnostic opportunity whereby some patients would be guided to personalized therapies. We believe that our platform's ability to support biomarkers for a broad range of therapeutics positions us to be a leader in therapy selection for patients. We are currently developing this diagnostic and we anticipate launch, initially for use in biopharmaceutical clinical trials, in 2019.

Material Agreements

VA MVP Agreement

On September 28, 2017, we entered into a contract with the VA for the VA MVP to provide them with a combination of whole genome sequencing services (the "VA MVP Agreement"). The performance period for the services includes a base period of one year (September 2017 to August 2018), with three one-year renewal option periods that may be exercised upon discretion of the VA MVP (September 2018 to August 2019; September 2019 to August 2020; and September 2020 to August 2021). Each task order issued against the VA MVP Agreement has a separate period of performance and is subject to the terms and conditions of the VA MVP Agreement. Funds are obligated by the VA MVP under each task order based on actual needs.

All materials and samples utilized during the course of the VA MVP Agreement and all data first produced or delivered under the VA MVP Agreement are the sole property of the VA MVP. Under the VA MVP Agreement, we are subject to confidentiality and security obligations, as well as various obligations upon events of default.

The VA MVP may terminate the VA MVP Agreement, or any part thereof, at its sole convenience. Subject to the terms of the VA MVP Agreement, we shall be paid a percentage of the contract price reflecting the percentage of the work performed prior to the notice of termination, plus reasonable charges that we can demonstrate have resulted from the termination.

The VA MVP may terminate the VA MVP Agreement, or any part thereof, for cause in the event of any default by us, or if we fail to comply with any contract terms and conditions, or fail to provide the VA MVP, upon request, with adequate assurances of future performance. In the event of termination for cause, the VA MVP shall not be liable to us for any amount for supplies or services not accepted, and we shall be liable to the VA MVP for any and all rights and remedies provided by law. If it is determined that the VA MVP improperly terminated this contract for default, such termination shall be deemed a termination for convenience.

Agreements with Illumina

On March 21, 2017 we received a quotation for supply of genetic analysis products (the "Quote") from Illumina. The Quote provided information as to the cost of five Illumina® Product Care NovaSeq®6000

Comprehensive Plans and five NovaSeq™6000 Sequencing System instruments. The term of the Quote extended through March 31, 2017. On March 31, 2017, we submitted a purchase order to Illumina for five NovaSeq™6000 Sequencing System instruments, all of which we have received. On March 1, 2019, we received another quotation for supply of genetic analysis products (the "Second Quote") from Illumina. The Second Quote provided information as to the cost of five NovaSeq™6000 Sequencing System instruments. The term of the Second Quote extended through March 31, 2019. On March 20, 2019, we submitted a purchase order to Illumina for five NovaSeq™6000 Sequencing System instruments, one of which we have received and four of which will be received on or before the due date of March 23, 2023.

On November 1, 2017, we entered into a master services subcontract agreement (the "Subcontract Agreement") with Illumina. Under the terms of the Subcontract Agreement, we engaged Illumina as our subcontractor to perform certain genotyping services (the "Services") on our behalf pursuant to written purchase orders in fulfillment of our VA MVP Agreement. The price for Illumina's Services set forth in the Subcontract Agreement is effective through December 31, 2021, or later if the VA MVP Agreement is extended.

The Subcontract Agreement extends through the last day of the VA MVP Agreement, currently August 2021 but as may be extended, unless it is otherwise terminated early pursuant to its terms. All or part of the Subcontract Agreement may be terminated at our convenience in the event that the VA MVP terminates the VA MVP Agreement or terminates the part of the VA MVP Agreement that affects the Services provided by Illumina. Each party may terminate the Subcontract Agreement for default in the event that the other party materially fails to perform any of the provisions of the Subcontract Agreement, materially fails to make progress so as to endanger performance of the Subcontract Agreement in accordance with its terms, or becomes financially or legally incapable of completing the work and does not provide a plan of correction or recovery within the provided period of time to cure such failure. The Subcontract Agreement may be renewed for subsequent one-year terms as agreed by the parties subject to a four-year limit.

On November 22, 2017, we entered into a pricing agreement with Illumina. The pricing agreement provided pricing terms for the NovaSeq™ 5000/6000 S4 Reagent Kit (each, a "Kit"). On March 26, 2019, we entered into a new pricing agreement with Illumina, which replaced in its entirety the agreement dated November 22, 2017. The new pricing agreement has a purchase commitment of $1.7 million by June 30, 2019 to purchase these Kits. The term of the pricing agreement extends through December 31, 2022.

On December 13, 2017, we received a Fast Track genetic analysis services agreement (the "Services Agreement") from Illumina that provides pricing information for the Infinium Global Screening Array V2.0 Fast Track Service. The term of the Services Agreement extends through June 30, 2019.

On February 22, 2019 we received a quotation for supply of genetic analysis products (the "Master Quote") from Illumina that provides for additional pricing terms on Illumina products. The term of the Master Quote extends through February 14, 2020.

Competition

We provide a comprehensive, exome-scale analysis of both a tumor and its microenvironment, including the immune cells, from a single tissue sample.

Our primary competition comes from companies offering genomic profiling services for either the tumor or the immune microenvironment. These companies offer services that implement various technological approaches including next-generation sequencing and microarray analyses. These competitors include Guardant Health, Inc., Foundation Medicine, Inc., which was acquired by Roche Holdings, Inc. in July 2018, Roche Molecular Systems, Inc., NanoString Technologies, Inc., Personal Genome Diagnostics, Inc., and Adaptive Biotechnologies Corporation.

Competitors within the broader genomics profiling space include laboratory companies such as Laboratory Corporation of America Holdings, Quest Diagnostics, Inc., Caris Life Sciences, Inc., Myriad Genetics, Inc., Tempus, Inc., InVitae Corp., BGI Group, Macrogen, Inc., Natera, Inc., Illumina, Thermo Fisher Scientific Inc., NeoGenomics, Inc., and MedGenome Inc. Additionally, several companies develop next-generation sequencing platforms that can be used for genomic profiling for biopharmaceutical research and development applications. These include Illumina, Thermo Fisher Scientific Inc., and other organizations that specialize in the development of next-generation sequencing instrumentation that can be sold directly to biopharmaceutical companies, clinical laboratories, and research centers. Separate from their instrumentation product lines, both Illumina and Thermo Fisher Scientific Inc., for example, currently market next-generation sequencing clinical oncology kits that are sold to customers who have bought and operate their respective sequencing instruments.

We believe that we compete favorably because of the integrity and comprehensiveness of the data generated by our NeXT Platform. Maximizing insights into both the tumor- and immune-related components of the tumor microenvironment is essential in identifying and understanding the reasons why certain cancer patients respond more favorably to oncology therapies than others. It is via access to such a comprehensive dataset for each patient that our customers can begin to discover new, clinically relevant biomarkers for the immunotherapy era, and ultimately improve cancer patient outcomes with the development of more efficacious therapeutics.

Intellectual Property

Protection of our intellectual property is fundamental to the long-term success of our business. Specifically, our success is dependent on our ability to obtain and maintain proprietary protection for our technology and the know-how related to our business, defend and enforce our intellectual property rights, and operate our business without infringing, misappropriating, or otherwise violating valid and enforceable intellectual property rights of others. We seek to protect our investments made into the development of our technology by relying on a combination of patents, trademarks, copyrights, trade secrets, know-how, confidentiality agreements and procedures, non-disclosure agreements with third parties, employee disclosure and invention assignment agreements, and other contractual rights.

Our patent strategy is focused on seeking coverage for our core technology, our ACE assay, and specific follow-on applications and implementations for enhancing sequencing coverage of certain genomic regions and analyzing cell-free nucleic acids. In addition, we file for patent protection on our ongoing research and development, particularly other novel assay technologies which may be applicable in cancer cases and other diseases.

Notwithstanding these efforts, we cannot be sure that patents will be granted with respect to any patent applications we have filed or may license or file in the future, and we cannot be sure that any patents we have or may be licensed or granted to us in the future, will not be challenged, invalidated, or circumvented, or that such patents will be commercially useful in protecting our technology. Moreover, we rely, in part, on trade secrets to protect aspects of our business that are not amenable to, or that we do not consider appropriate for, patent protection. However, trade secrets can be difficult to protect. While we take steps to protect and preserve our trade secrets, including by entering into confidentiality agreements with our employees, consultants, scientific advisors, and contractors, and maintaining physical security of our premises and physical and electronic security of our information technology systems, such measures can be breached, and we may not have adequate remedies for any such breach. In addition, our trade secrets may otherwise become known or be independently discovered by competitors. For more information regarding the risks related to our intellectual property, please see “Risk Factors—Risks Related to Our Intellectual Property.”

Our patent portfolio is comprised of patents and patent applications owned by the company. These patents and patent applications generally fall into four broad categories:

- our ACE assay technology, including claims directed to methods for enriching sample nucleic acids based on differences in GC-content, molecular size, presence of genetic variations or rearrangements, epigenetic modifications, and species-origin (e.g., human and non-human);

- hybrid exome-genome technologies, including claims directed to methods for combining exome and genome sequencing data generated from a sample to identify polymorphisms;
- liquid biopsy methods, including claims directed to methods of analyzing sequenced cell-free and leukocyte-derived nucleic acids in a blood sample to identify a tissue source, or recommend a drug treatment; and
- clinical interpretation methods, including claims directed to methods of ranking genes associated with a phenotype and inheritance pattern.

As of May 9, 2019, we own ten issued U.S. and foreign patents in China and the United Kingdom and several pending U.S. and foreign patent applications. Issued U.S. patents in our portfolio of company-owned patents and patent applications are expected to expire between 2033 and 2035, excluding any additional term for patent term adjustments or patent term extensions.

Government Regulations

Federal and State Laboratory Licensing Requirements

Under the Clinical Laboratory Improvement Amendments of 1988 ("CLIA"), a laboratory is any facility that performs laboratory testing on specimens derived from humans for the purpose of providing information for the diagnosis, prevention or treatment of disease, or the impairment of or assessment of health. CLIA requires that a laboratory hold a certificate applicable to the type of laboratory examinations it performs and that it complies with, among other things, standards covering operations, personnel, facilities administration, quality systems and proficiency testing, which are intended to ensure, among other things, that clinical laboratory testing services are accurate, reliable and timely.

To renew our CLIA certificate, we are subject to survey and inspection every two years to assess compliance with program standards. Because we are a College of American Pathologists ("CAP") accredited laboratory, the Centers for Medicare & Medicaid Services ("CMS") does not perform this survey and inspection and relies on our CAP survey and inspection. We also may be subject to additional unannounced inspections. Laboratories performing high complexity testing are required to meet more stringent requirements than laboratories performing less complex tests. In addition, a laboratory that is certified as "high complexity" under CLIA may develop, manufacture, validate, and use proprietary tests referred to as laboratory developed tests ("LDTs"). CLIA requires analytical validation including accuracy, precision, specificity, sensitivity, and establishment of a reference range for any LDT used in clinical testing. The regulatory and compliance standards applicable to the testing we perform may change over time, and any such changes could have a material effect on our business.

CLIA provides that a state may adopt laboratory regulations that are more stringent than those under federal law, and a number of states have implemented their own more stringent laboratory regulatory requirements. State laws may require that nonresident laboratories, or out-of-state laboratories, maintain an in-state laboratory license to perform tests on samples from patients who reside in that state. As a condition of state licensure, these state laws may require that laboratory personnel meet certain qualifications, specify certain quality control procedures or facility requirements, or prescribe record maintenance requirements. Because our laboratory is located in the state of California, we are required to and do maintain a California state laboratory license. We also maintain licenses to conduct testing in other states where nonresident laboratories are required to obtain state laboratory licenses. We maintain a current license with the New York State Department of Health for our laboratory. Other states may currently have or adopt similar licensure requirements in the future, which may require us to modify, delay, or stop its operations in those states.

Failure to comply with CLIA certification and state clinical laboratory licensure requirements may result in a range of enforcement actions, including certificate or license suspension, limitation, or revocation, directed plan

of action, onsite monitoring, civil monetary penalties, criminal sanctions, and revocation of the laboratory's approval to receive Medicare and Medicaid payment for its services, as well as significant adverse publicity.

Regulatory framework for medical devices in the United States

Pursuant to its authority under the Federal Food, Drug and Cosmetic Act (the "FDC Act"), the FDA has jurisdiction over medical devices, which are defined to include, among other things, in vitro diagnostic devices ("IVDs"). The FDA regulates, among other things, the research, design, development, pre-clinical and clinical testing, manufacturing, safety, effectiveness, packaging, labeling, storage, recordkeeping, pre-market clearance or approval, adverse event reporting, marketing, promotion, sales, distribution, and import and export of medical devices. Unless an exemption applies, each new or significantly modified medical device we seek to commercially distribute in the United States will require either a premarket notification to the FDA requesting permission for commercial distribution under Section 510(k) of the FDC Act, also referred to as a 510(k) clearance, or approval from the FDA of a PMA. Both the 510(k) clearance and PMA processes can be resource intensive, expensive, and lengthy, and require payment of significant user fees.

FDA Regulation of Laboratory Developed Tests

Although the FDA regulates medical devices, including IVDs, the FDA has historically exercised its enforcement discretion and not enforced applicable provisions of the FDC Act and FDA regulations with respect to LDTs, which are a subset of IVDs that are intended for clinical use and developed, validated, and offered within a single laboratory for use only in that laboratory. We currently intend to market a diagnostic test based on the NeXT Platform as an LDT. As a result, we believe our diagnostic services are not currently subject to the FDA's enforcement of its medical device regulations and the applicable FDC Act provisions.

Legislative and administrative proposals addressing oversight of LDTs were introduced in recent years and we expect that new legislative and administrative proposals will be introduced from time to time. It is possible that legislation could be enacted into law or regulations or guidance could be issued by the FDA, which may result in new or increased regulatory requirements for us to continue to offer our LDTs or to develop and introduce new tests as LDTs. For example, in 2014 the FDA issued two draft guidance documents proposing a risk-based framework with respect to applying the FDA's oversight over LDTs. The framework guidance stated that the FDA intended to modify its policy of enforcement discretion with respect to LDTs in a risk-based manner consistent with the existing classification of medical devices. Thus, the FDA planned to begin to enforce its medical device requirements, including premarket submission requirements, on LDTs that have historically been marketed without FDA premarket review and oversight. In November 2016, the FDA announced its intention not to finalize the 2014 draft guidance to allow for further public discussion on an appropriate oversight approach to LDTs and to give congressional authorizing committees the opportunity to develop a legislative solution. In January 2017, the FDA issued a discussion paper on possible approaches to the regulation of LDTs.

Federal and State Fraud and Abuse Laws

We are subject to federal fraud and abuse laws such as the federal Anti-Kickback Statute (the "AKS"), the federal prohibition against physician self-referral (the "Stark Law"), and the federal false claims law, or the False Claims Act (the "FCA"). We are also subject to similar state and foreign fraud and abuse laws.

The AKS prohibits, among other things, knowingly and willfully offering, paying, soliciting, or receiving remuneration, directly or indirectly, overtly or covertly, in cash or in kind, in return for or to induce such person to refer an individual, or to purchase, lease, order, arrange for, or recommend purchasing, leasing, or ordering, any good, facility, item, or service that is reimbursable, in whole or in part, under a federal healthcare program.

The Stark Law and similar state laws, including California's Physician Ownership and Referral Act, generally prohibit, among other things, clinical laboratories and other entities from billing a patient or any

governmental or commercial payer for any diagnostic services when the physician ordering the service, or any member of such physician's immediate family, has a direct or indirect investment interest in or compensation arrangement with us, unless the arrangement meets an exception to the prohibition.

Other federal fraud and abuse laws to which we are subject include, but are not limited to, the federal civil and criminal false claims laws including the FCA, which imposes liability on any person or entity that, among other things, knowingly presents, or causes to be presented, a false or fraudulent claim for payment to the federal government, and the federal Civil Monetary Penalties Law, which prohibits, among other things, the offering or transfer of remuneration to a Medicare or state healthcare program beneficiary if the person knows or should know it is likely to influence the beneficiary's selection of a particular provider, practitioner, or supplier of services reimbursable by Medicare or a state healthcare program, unless an exception applies. Under the FCA, private citizens can bring claims on behalf of the government through qui tam actions. We must also operate within the bounds of the fraud and abuse laws of the states in which we do business which may apply to items or services reimbursed by non-governmental third-party payers, including private insurers.

Efforts to ensure that our business arrangements with third parties will comply with applicable healthcare laws and regulations will involve substantial costs. If our operations are found to be in violation of any of these laws or any other governmental regulations that may apply to us, we may be subject to significant civil, criminal and administrative penalties, damages, fines, imprisonment, exclusion from government-funded healthcare programs, such as Medicare and Medicaid, disgorgement, contractual damages, reputational harm, diminished profits and future earnings, additional reporting, or oversight obligations if we become subject to a corporate integrity agreement or other agreement to resolve allegations of non-compliance with the law and the curtailment or restructuring of our operations. If any of the physicians or other healthcare providers or entities with whom we do business is found to be not in compliance with applicable laws, they may be subject to significant criminal, civil or administrative sanctions, including exclusions from government-funded healthcare programs.

HIPAA and HITECH

Under the administrative simplification provisions of the Health Insurance Portability and Accountability Act of 1996 ("HIPAA"), as amended by the Health Information Technology for Economic and Clinical Health Act "HITECH"), the U.S. Department of Health and Human Services ("HHS") issued regulations that establish uniform standards governing the conduct of certain electronic healthcare transactions and requirements for protecting the privacy and security of protected health information ("PHI"), used or disclosed by covered entities and business associates. Covered entities and business associates are subject to HIPAA and HITECH. Our subcontractors that create, receive, maintain, transmit, or otherwise process PHI on behalf of us are HIPAA "business associates" and must also comply with HIPAA as a business associate.

HIPAA and HITECH include privacy and security rules, breach notification requirements, and electronic transaction standards.

The Privacy Rule covers the use and disclosure of PHI by covered entities and business associates. The Privacy Rule generally prohibits the use or disclosure of PHI, except as permitted under the Rule. The Privacy Rule also sets forth individual patient rights, such as the right to access or amend certain records containing his or her PHI, or to request restrictions on the use or disclosure of his or her PHI.

The Security Rule requires covered entities and business associates to safeguard the confidentiality, integrity, and availability of electronically transmitted or stored PHI by implementing administrative, physical, and technical safeguards. Under HITECH's Breach Notification Rule, a covered entity must notify individuals, the Secretary of the HHS, and in some circumstances, the media of breaches of unsecured PHI.

In addition, we may be subject to state health information privacy and data breach notification laws, which may govern the collection, use, disclosure, and protection of health-related and other personal information.

California, for example, has enacted the Confidentiality of Medical Information Act, which sets forth standards in addition to HIPAA and HITECH with which all California health care providers like us must abide. State laws may be more stringent, broader in scope, or offer greater individual rights with respect to PHI than HIPAA, and state laws may differ from each other, which may complicate compliance efforts.

Entities that are found to be in violation of HIPAA as the result of a failure to secure PHI, a complaint about our privacy practices or an audit by HHS, may be subject to significant civil and criminal fines and penalties and additional reporting and oversight obligations if such entities are required to enter into a resolution agreement and corrective action plan with HHS to settle allegations of HIPAA non-compliance.

U.S. Healthcare Reform

In the United States, there have been a number of legislative and regulatory changes at the federal and state levels that seek to reduce healthcare costs and improve the quality of healthcare. For example, in March 2010, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act (collectively, the "ACA"), became law. This law substantially changed the way health care is financed by both commercial payers and government payers, and significantly impacted our industry. The ACA contained a number of provisions expected to impact the clinical laboratory industry, such as changes governing enrollment in state and federal health care programs, reimbursement changes, and fraud and abuse.

Some of the provisions of the ACA have yet to be implemented, and there have been judicial and Congressional challenges to certain aspects of the ACA, as well as recent efforts by the Trump administration to repeal or replace certain aspects of the ACA. Since January 2017, President Trump has signed two executive orders and other directives designed to delay the implementation of certain provisions of the ACA. Concurrently, Congress has considered legislation that would repeal or repeal and replace all or part of the ACA. While Congress has not passed comprehensive repeal legislation, it has enacted laws that modify certain provisions of the ACA such as removing penalties, starting January 1, 2019, for not complying with the ACA's individual mandate to carry health insurance and delaying the implementation of certain ACA-mandated fees. On December 14, 2018, a Texas U.S. District Court Judge ruled that the ACA is unconstitutional in its entirety because the "individual mandate" was repealed by Congress as part of the Tax Cuts and Jobs Act of 2017. While the Texas U.S. District Court Judge, as well as the Trump administration and CMS, have stated that the ruling will have no immediate effect pending appeal of the decision, it is unclear how this decision, subsequent appeals, and other efforts to repeal and replace the ACA will impact the ACA.

We anticipate there will continue to be proposals by legislators at both the federal and state levels, regulators and commercial payers to reduce costs while expanding individual healthcare benefits. Certain of these changes could impose additional limitations on the prices we will be able to charge for our tests, the coverage of or the amounts of reimbursement available for our tests from payers, including commercial payers and government payers.

Our Employees

As of March 31, 2019, we had 147 full-time employees, with 64 in research and development, 47 in laboratory operations, 19 in commercial operations and 17 in general and administrative functions. Of these full-time employees, 144 are located in the United States (including 135 who work at our corporate headquarters in Menlo Park, California and 9 who work remotely) and three are located in the United Kingdom and Germany. As of March 31, 2019, more than 60 of our full-time employees had completed a Ph.D. or other advanced science or medical degree.

None of our employees is represented by a labor union or covered by collective bargaining agreements, and we have not experienced any work stoppages. We consider our relations with our employees to be good.

Our Facilities

Our corporate headquarters are located in Menlo Park, California, and comprise approximately 31,280 square feet of space, pursuant to an operating lease that expires in 2020. This lease includes an option to extend for an additional three years, at market rates that prevail at the time of our election to extend. Our CLIA-certified laboratory is located in this facility.

We believe that this facility is sufficient to meet our current needs. We also believe we will be able to obtain additional space, as needed, on commercially reasonable terms.

Legal Proceedings

From time to time, we are involved in various legal proceedings arising from the normal course of business activities. We are not presently a party to any litigation the outcome of which, we believe, if determined adversely to us, would individually or taken together have a material adverse effect on our business, operating results, cash flows, or financial condition. Defending such proceedings is costly and can impose a significant burden on management and employees, we may receive unfavorable preliminary or interim rulings in the course of litigation, and there can be no assurances that favorable final outcomes will be obtained.

MANAGEMENT

The following table sets forth information for our executive officers and directors as of March 31, 2019:

Name	Age	Position
Executive Officers		
John West	62	President, Chief Executive Officer and Director
Richard Chen, M.D., M.S.	48	Chief Scientific Officer
Clinton Musil	38	Chief Business Officer
Aaron Tachibana	58	Chief Financial Officer
Non-Employee Directors		
Patrick Balthrop(2)(3)	62	Director
A. Blaine Bowman(1)	72	Director
Alan Colowick, M.D.(3)	56	Director
Kenneth Ludlum(1)	65	Director
Jonathan MacQuitty, Ph.D.(2)	66	Chairman of the Board
Paul Ricci(1)(2)	62	Director

(1) Member of the audit committee.
(2) Member of the compensation committee.
(3) Member of the nominating and corporate governance committee.

Executive Officers

John West. Mr. West is one of our founders and has served as Chief Executive Officer and as a member of our board of directors since August 2011. From May 2009 to July 2011, Mr. West served as Chief Executive Officer of ViaCyte, Inc., a regenerative medicine company. From August 2004 to January 2008, Mr. West served in various roles, including Chief Executive Officer from August 2004 to March 2005 at Solexa, Ltd., a DNA sequencing company, which became Solexa, Inc., Chief Executive Officer from March 2005 to January 2007 at Solexa, Inc., and Senior Vice President of DNA Sequencing from January 2007 to January 2008 at Illumina, Inc., a biotechnology company, after the sale of Solexa, Inc. to Illumina, Inc. Mr. West's earlier career included positions related to DNA sequencing automation. Mr. West holds a B.S. in Nuclear Engineering and an M.S. in Mechanical Engineering from Massachusetts Institute of Technology and an M.B.A. from the Wharton School at the University of Pennsylvania. Mr. West was selected to serve on our board of directors because of the perspective and experience he brings as our Chief Executive Officer and his operating and management experience in the healthcare technology industry, particularly related to DNA sequencing and its applications.

Richard Chen, M.D., M.S. Dr. Chen has served as our Chief Scientific Officer since November 2011. Since September 2011, Dr. Chen has served on the clinical faculty at Stanford University School of Medicine. In August 1997, Dr. Chen co-founded Ingenuity Systems, a genomic data software company. Dr. Chen holds a B.S. in Computer Science from Stanford University, an M.S. in Medical Informatics from Stanford University School of Medicine, and an M.D. from Stanford University School of Medicine.

Clinton Musil. Mr. Musil has served as our Chief Business Officer since December 2018. From September 2017 to July 2018, Mr. Musil served as Vice President, Corporate Development at ARMO Biosciences, an immuno-oncology company that was acquired by Eli Lilly and Company. From July 2017 to September 2017, Mr. Musil served as a Managing Director at Hercules Capital, an investment firm. From September 2014 to March 2017, Mr. Musil served as a Vice President in the Healthcare Investment Banking Group at Deutsche Bank AG, an investment bank. From July 2013 to July 2014, Mr. Musil served as a Vice President in the

Healthcare Investment Banking Group at Wells Fargo & Company, an investment bank. Earlier in his career, Mr. Musil was an investor at Essex Woodlands, a healthcare-focused investment fund. Mr. Musil holds a B.S. in Molecular and Cellular Biology from the University of Arizona and an M.B.A. from Harvard Business School.

Aaron Tachibana. Mr. Tachibana has served as our Chief Financial Officer since March 2019. From August 2015 to September 2018, Mr. Tachibana served as Chief Financial Officer at Lumentum Holdings Inc., a designer and manufacturer of optical and photonic products. From November 2013 to July 2015, Mr. Tachibana served as Vice President, Finance and Corporate Controller at JDS Uniphase Corp., subsequently renamed Viavi Solutions Inc., a network test, measurement, and assurance technology company. From March 2010 to October 2013, Mr. Tachibana served as Chief Financial Officer at Pericom Semiconductor Corp., a supplier of high-performance connectivity and timing solutions. Mr. Tachibana holds a B.S. in Business Administration and Finance from San Jose State University.

Non-Employee Directors

***Patrick Balthrop*.** Mr. Balthrop has served on our board of directors since July 2015. Since February 2016, Mr. Balthrop has served on the board of directors of Oxford Immunotec Global PLC, a diagnostics company. Since January 2015, Mr. Balthrop has been the Founding Principal of Apalachee Ventures, LLC, an investment and advisory firm. From September 2004 to October 2014, Mr. Balthrop served on the board of directors and as Chief Executive Officer, President, and Director of Luminex Corporation, a diagnostics, tools, and devices company. Mr. Balthrop holds a B.S. in Biology from Spring Hill College and an M.B.A. from the Kellogg School of Management at Northwestern University. Mr. Balthrop was selected to serve on our board of directors because of his management experience in the healthcare and medical device industry.

A. Blaine Bowman. Mr. Bowman has served on our board of directors since May 2019. Beginning in 2006, Mr. Bowman served on the board of directors of Solexa, Inc., a DNA sequencing company, until its sale to Illumina, Inc., a biotechnology company, after which Mr. Bowman continued to serve on the board of directors until May 2018. From March 1977 to August 2005, Mr. Bowman served in various roles at Dionex Corporation, a manufacturer of analytical instruments, including Chairman of the board of directors, President, and Chief Executive Officer, and he served on the board of directors until its sale to Thermo Fisher Scientific Inc. in May 2011. From July 2012 to December 2015, Mr. Bowman served on the board of directors of Altera Corporation, a programmable logic devices company. Mr. Bowman holds a B.S. in Physics from Brigham Young University and an M.B.A. from the Stanford Graduate School of Business. Mr. Bowman was selected to serve on our board of directors because of his experience in executive roles and his experience serving on the boards of directors of various instrumentation and biotechnology companies.

Alan Colowick, M.D. Dr. Colowick has served on our board of directors since May 2019. Since May 2017, Dr. Colowick has served as a Partner at Sofinnova Investment, Inc., a clinical stage life sciences venture capital firm. From February 2010 to April 2017, Dr. Colowick held various positions, including Executive Vice President, at Celgene Corporation, a pharmaceutical company. From February 2008 to January 2010, Dr. Colowick served as the Chief Executive Officer of Gloucester Pharmaceuticals Inc., an early stage cancer pharmaceutical company, until its acquisition by Celgene Corporation in January 2010. From October 2006 to February 2008, Dr. Colowick served as President, Oncology at Geron Corporation, an early stage pharmaceutical company. Earlier in his career, Dr. Colowick served in various capacities at Amgen Inc., a biopharmaceutical company. Dr. Colowick has served on the board of directors of Human Longevity, Inc., a genomics-based health intelligence company, since June 2016, and has served on the board of directors of Principia Biopharma Inc., a biopharmaceutical company, since February 2017. Dr. Colowick previously served on the board of directors of Achaogen, Inc., a biopharmaceutical company, from August 2015 to August 2017, and on the board of directors of Dimension Therapeutics, Inc., a biopharmaceutical company, from August 2015 to November 2017. Dr. Colowick holds a B.S. in Molecular Biology from the University of Colorado, an M.D. from Stanford University School of Medicine, and an M.P.H. from the Harvard School of Public Health. Dr. Colowick was selected to serve on our board of directors because of his educational background in sciences, as well as financial understanding of the biotechnology industry gained from his investing experience.

Kenneth Ludlum. Mr. Ludlum has served on our board of directors since July 2015. Since January 2002, Mr. Ludlum has served on the board of directors of NATUS Medical, Inc., a medical device and equipment company. From February 2014 to April 2016, Mr. Ludlum served as Chief Financial Officer at CareDx, a molecular diagnostics company. Mr. Ludlum holds a B.S. in Business Administration from Lehigh University and an M.B.A. from Columbia Business School. Mr. Ludlum was selected to serve on our board of directors because of his experience working for and with healthcare, medical device, biotechnology, and diagnostic companies and his expertise in finance, accounting, and general management.

Jonathan MacQuitty, Ph.D. Dr. MacQuitty, our Chairman of the Board, has served on our board of directors since June 2011. Since July 2018, Dr. MacQuitty has served on the board of directors of and as Chief Executive Officer of D2G Oncology, Inc., an oncology biotechnology company. Since April 2016, Dr. MacQuitty has served as a Venture Partner at Lightspeed Venture Partners, an early-stage technology venture capital firm. From May 2015 to April 2017, Dr. MacQuitty served as Chief Executive Officer of Forty Seven, Inc., an immuno-oncology company. From May 1999 to December 2014, Dr. MacQuitty served in various roles, including Partner, at Abingworth Management Inc., a trans-Atlantic bio-investment firm. Dr. MacQuitty holds a B.A. and M.A. in Chemistry from Oxford University, a Ph.D. in Chemistry from the University of Sussex, and an M.B.A. from the Stanford Graduate School of Business. Dr. MacQuitty was selected to serve on our board of directors because of his operational experience in life science companies.

Paul Ricci. Mr. Ricci has served on our board of directors since February 2019. Since October 2018, Mr. Ricci has served as an Advisor to Lightspeed Venture Partners, an early-stage technology venture capital firm. Since September 2018, Mr. Ricci has served as an Advisor to Warburg Pincus, a private equity firm. Mr. Ricci served as Chief Executive Officer of Nuance Communications, Inc., a computer software technology company, from August 2000 to March 2018 and as its Chairman from March 1999 to February 2018. Mr. Ricci holds a B.A. and an M.A. in Economics from Stanford University. Mr. Ricci was selected to serve on our board of directors because of his management abilities and experience.

Composition of Our Board of Directors

Our business and affairs are managed under the direction of our board of directors. We currently have seven directors and two vacancies. The following members of our board of directors were elected pursuant to our current certificate of incorporation, as amended, and under the provisions of our amended and restated voting agreement, which requires the stockholders who are party to the agreement to vote their respective shares of our capital stock to elect directors as follows:

- John West, as the individual serving as our Chief Executive Officer and elected by the holders of our common stock;
- one individual designated by Abingworth Bioventures V LP and elected by the holders of our preferred stock (currently vacant);
- Jonathan MacQuitty, Ph.D., as the individual designated by Lightspeed General Partner VIII, L.P. and elected by the holders of our preferred stock;
- one individual jointly designated by Abingworth Bioventures V LP and Lightspeed General Partner VIII, L.P. and elected by the holders of our preferred stock (currently vacant); and
- Patrick Balthrop, Alan Colowick, M.D., and Kenneth Ludlum, as independent individuals designated by our board of directors and elected by the holders of our capital stock.

In addition, pursuant to our current certificate of incorporation, as amended, the holders of our capital stock elected A. Blaine Bowman and Paul Ricci as at-large directors.

The provisions of our amended and restated voting agreement relating to the election of our directors will terminate and the provisions of our current certificate of incorporation by which our directors were elected will

be amended and restated in connection with this offering. After the closing of this offering, the number of directors will be fixed by our board of directors, subject to the terms of our amended and restated certificate of incorporation and amended and restated bylaws that will become effective immediately prior to the closing of this offering. Each of our current directors will continue to serve as a director until the election and qualification of their successor, or until their earlier death, resignation, or removal.

Our board of directors may establish the authorized number of directors from time to time by resolution. In accordance with our amended and restated certificate of incorporation that will be in effect on the closing of this offering, immediately after this offering our board of directors will be divided into three classes with staggered three-year terms. At each annual general meeting of stockholders, the successors to directors whose terms then expire will be elected to serve from the time of election and qualification until the third annual meeting following election. Our directors will be divided among the three classes as follows:

- the Class I directors will be Messrs. Balthrop and Ludlum, and their terms will expire at our first annual meeting of stockholders following this offering;
- the Class II directors will be Messrs. West and Ricci and Dr. Colowick, and their terms will expire at our second annual meeting of stockholders following this offering; and
- the Class III directors will be Mr. Bowman and Dr. MacQuitty, and their terms will expire at our third annual meeting of stockholders following this offering.

We expect that any additional directorships resulting from an increase in the number of directors will be distributed among the three classes so that, as nearly as possible, each class will consist of one third of the directors. The division of our board of directors into three classes with staggered three-year terms may delay or prevent a change of our management or a change in control.

Director Independence

Our board of directors has undertaken a review of the independence of each director. Based on information provided by each director concerning his background, employment, and affiliations, our board of directors has determined that Messrs. Balthrop, Bowman, Ludlum, and Ricci and Drs. Colowick and MacQuitty do not have relationships that would interfere with the exercise of independent judgment in carrying out the responsibilities of a director and that each of these directors is “independent” as that term is defined under the applicable listing standards. In making these determinations, our board of directors considered the current and prior relationships that each non-employee director has with our company and all other facts and circumstances our board of directors deemed relevant in determining their independence, including the beneficial ownership of our shares held by each non-employee director and the transactions described in the section titled “Certain Relationships and Related Party Transactions.”

Committees of Our Board of Directors

Our board of directors has established an audit committee, a compensation committee, and a nominating and corporate governance committee. The composition and responsibilities of each of the committees of our board of directors are described below. Members serve on these committees until their resignation or until otherwise determined by our board of directors. Our board of directors may establish other committees as it deems necessary or appropriate from time to time.

Audit Committee

Our audit committee consists of Messrs. Bowman, Ludlum, and Ricci. Our board of directors has determined that each member of the audit committee satisfies the independence requirements under the Nasdaq listing standards and Rule 10A-3(b)(1) of the Exchange Act. The chair of our audit committee is Mr. Ludlum.

Our board of directors has determined that each of Mr. Ludlum, Mr. Bowman, and Mr. Ricci is an "audit committee financial expert" within the meaning of SEC regulations. Each member of our audit committee can read and understand fundamental financial statements in accordance with applicable requirements. In arriving at these determinations, our board of directors has examined each audit committee member's scope of experience and the nature of their employment.

The primary purpose of the audit committee is to discharge the responsibilities of our board of directors with respect to our corporate accounting and financial reporting processes, systems of internal control and financial statement audits, and to oversee our independent registered public accounting firm. Specific responsibilities of our audit committee include:

- helping our board of directors oversee our corporate accounting and financial reporting processes;
- managing the selection, engagement, qualifications, independence, and performance of a qualified firm to serve as the independent registered public accounting firm to audit our financial statements;
- discussing the scope and results of the audit with the independent registered public accounting firm, and reviewing, with management and the independent accountants, our interim and year-end operating results;
- developing procedures for employees to submit concerns anonymously about questionable accounting or audit matters;
- reviewing related person transactions;
- obtaining and reviewing a report by the independent registered public accounting firm at least annually that describes our internal quality control procedures, any material issues with such procedures, and any steps taken to deal with such issues when required by applicable law; and
- approving or, as permitted, pre-approving, audit and permissible non-audit services to be performed by the independent registered public accounting firm.

Our audit committee will operate under a written charter, to be effective prior to the closing of this offering, that satisfies the applicable listing standards of Nasdaq.

Compensation Committee

Our compensation committee consists of Messrs. Balthrop and Ricci and Dr. MacQuitty. The chair of our compensation committee is Dr. MacQuitty. Our board of directors has determined that each member of the compensation committee is independent under the listing standards of Nasdaq, and a "non-employee director" as defined in Rule 16b-3 promulgated under the Exchange Act.

The primary purpose of our compensation committee is to discharge the responsibilities of our board of directors in overseeing our compensation policies, plans and programs and to review and determine the compensation to be paid to our executive officers, directors and other senior management, as appropriate. Specific responsibilities of our compensation committee include:

- reviewing and recommending to our board of directors the compensation of our chief executive officer and other executive officers;
- reviewing and recommending to our board of directors the compensation of our directors;
- administering our equity incentive plans and other benefit programs;
- reviewing, adopting, amending, and terminating incentive compensation and equity plans, severance agreements, profit sharing plans, bonus plans, change-of-control protections, and any other compensatory arrangements for our executive officers and other senior management; and

- reviewing and establishing general policies relating to compensation and benefits of our employees, including our overall compensation philosophy.

Our compensation committee will operate under a written charter, to be effective prior to the closing of this offering, that satisfies the applicable listing standards of Nasdaq.

Nominating and Corporate Governance Committee

Our nominating and corporate governance committee consists of Mr. Balthrop and Dr. Colowick. The chair of our nominating and corporate governance committee is Mr. Balthrop. Our board of directors has determined that each member of the nominating and corporate governance committee is independent under the listing standards of Nasdaq.

Specific responsibilities of our nominating and corporate governance committee include:

- identifying and evaluating candidates, including the nomination of incumbent directors for reelection and nominees recommended by stockholders, to serve on our board of directors;
- considering and making recommendations to our board of directors regarding the composition and chairmanship of the committees of our board of directors;
- developing and making recommendations to our board of directors regarding corporate governance guidelines and matters; and
- overseeing periodic evaluations of the board of directors' performance, including committees of the board of directors.

Our nominating and corporate governance committee will operate under a written charter, to be effective prior to the closing of this offering, that satisfies the applicable listing standards of Nasdaq.

Code of Business Conduct and Ethics

We have adopted a code of business conduct and ethics that applies to our directors, officers, and employees, including our principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions. Upon the closing of this offering, our code of business conduct and ethics will be available under the Corporate Governance section of our website at https://www.personalis.com. In addition, we intend to post on our website all disclosures that are required by law or the listing standards of Nasdaq concerning any amendments to, or waivers from, any provision of the code. The reference to our website address does not constitute incorporation by reference of the information contained at or available through our website, and you should not consider it to be a part of this prospectus.

Compensation Committee Interlocks and Insider Participation

None of the members of the compensation committee is currently or has been at any time one of our officers or employees. None of our executive officers currently serves, or has served during the last year, as a member of the board of directors or compensation committee of any entity that has one or more executive officers serving as a member of our board of directors or compensation committee.

Non-Employee Director Compensation

During fiscal 2018, we did not pay cash compensation to any of our non-employee directors for service on our board of directors.

In April 2018, the board of directors granted a stock option to purchase 12,500 shares of our common stock to Mr. Balthrop at an exercise price per share of $3.80. The shares underlying the option vest in 12 equal monthly

installments measured from August 17, 2018, subject to Mr. Balthrop's continuous service with us as of each such vesting date. In April 2018, the board of directors granted a stock option to purchase 12,500 shares of our common stock to Mr. Ludlum at an exercise price per share of $3.80. The shares underlying the option vest in 12 equal monthly installments measured from June 20, 2018, subject to Mr. Ludlum's continuous service with us as of each such vesting date. In April 2018, the board of directors granted a stock option to purchase 18,750 shares of our common stock to Dr. MacQuitty at an exercise price per share of $3.80. The shares underlying the option vest in 12 equal monthly installments measured from February 1, 2018, subject to Dr. MacQuitty's continuous service with us as of each such vesting date.

Upon a change in control (as defined in the 2011 Plan), the vesting of each option described above shall accelerate in full.

In addition, we have reimbursed and will continue to reimburse all of our non-employee directors for their reasonable out-of-pocket expenses incurred in attending board of directors and committee meetings.

The following table sets forth information regarding the compensation earned by or paid to our directors during the year ended December 31, 2018, other than John West, our President and Chief Executive Officer, who is also a member of our board of directors but did not receive any additional compensation for service as a director. The compensation of Mr. West as a named executive officer is set forth below under "Executive Compensation—Summary Compensation Table." Because each of A. Blaine Bowman, Alan Colowick, and Paul Ricci joined our board of directors in 2019 and did not earn or receive any compensation from us in 2018, Mr. Bowman, Dr. Colowick, and Mr. Ricci are not included in the following table.

Name	Fees Earned or Paid in Cash ($)	Option Awards ($)(1)	Total ($)
Patrick Balthrop	—	26,146	26,146
Kenneth Ludlum	—	26,146	26,146
Jonathan MacQuitty, Ph.D.	—	39,276	39,276
Vincent Miles, Ph.D.(2)	—	—	—
Christopher Schaepe(3)	—	—	—

(1) The amounts reported represent the aggregate grant date fair value of the stock options granted during fiscal 2018 under our 2011 Plan, computed in accordance with Financial Accounting Standards Board Accounting Standards Codification, Topic 718 ("ASC Topic 718"). The assumptions used in calculating the grant date fair value of the stock options reported in this column are set forth in the notes to our consolidated financial statements included elsewhere in this prospectus. This amount does not reflect the actual economic value that may be realized by the non-employee director.

(2) Dr. Miles resigned as a member of our board of directors on May 1, 2019.

(3) Mr. Schaepe resigned as a member of our board of directors on March 21, 2019.

EXECUTIVE COMPENSATION

Our named executive officers for the fiscal year ended December 31, 2018, consisting of our principal executive officer and the next two most highly compensated executive officers, were:

- John West, our President and Chief Executive Officer;
- Clinton Musil, our Chief Business Officer; and
- Richard Chen, M.D., M.S., our Chief Scientific Officer.

Summary Compensation Table

The following table presents all of the compensation awarded to, earned by, or paid to our named executive officers during the fiscal year ended December 31, 2018:

Name	Year	Salary ($)	Bonus ($)	Option Awards ($)(1)	Non-Equity Incentive Plan Compensation(2) ($)	All Other Compensation ($)	Total ($)
John West *President and Chief Executive Officer*	2018	421,750	—	879,452	190,250(3)	—	1,491,452
Clinton Musil *Chief Business Officer*	2018(4)	13,542	—	1,053,204	—	—	1,066,746
Richard Chen, M.D., M.S. *Chief Scientific Officer*	2018	370,031	—	335,934	135,000	—	840,965

(1) The amounts disclosed represent the aggregate grant date fair value of the stock options granted to our named executive officers during fiscal 2018 under our 2011 Plan, computed in accordance with ASC Topic 718. The assumptions used in calculating the grant date fair value of the stock options are set forth in the notes to our audited consolidated financial statements included elsewhere in this prospectus. This amount does not reflect the actual economic value that may be realized by the named executive officer.

(2) The amount disclosed represents the executive officer's total performance bonus earned for fiscal 2018 as described below under "—Annual Bonus Plan."

(3) The amount disclosed represents the grant date fair value of a stock option granted to Mr. West in 2019 in lieu of a performance-based cash bonus earned with respect to fiscal 2018 performance as described below under "—Annual Bonus Plan."

(4) Mr. Musil began serving as our Chief Business Officer in December 2018.

Annual Bonus Plan

Our executive officers are eligible to receive performance-based cash bonuses, which are designed to provide appropriate incentives to our executives to achieve defined performance goals and to reward our executives for individual achievement toward these goals. The performance-based bonus each executive officer is eligible to receive is generally based on the extent to which we achieve the corporate goals that our board or compensation committee establishes and is paid annually. Annually, the compensation committee of our board of directors reviews the company's performance and determines the actual bonus payout to be awarded to each of our eligible executive officers.

Bonuses based on fiscal 2017 performance were paid in April 2018. Because the compensation committee of our board of directors determined that the performance goals with respect to the fiscal 2017 bonuses were achieved at the 100% level, the 2017 bonuses were paid at the 100% level. Mr. West earned a bonus for fiscal 2017 performance based on our achievement of the relevant performance targets for Mr. West. At the request of

Mr. West, the board of directors determined to pay his 2017 bonus in the form of a fully vested stock option grant exercisable for 25,000 shares of common stock. Because Mr. Musil began his employment with us in December 2018, he was not eligible for any fiscal 2017 bonus. Dr. Chen earned a bonus for fiscal 2017 performance based on our achievement of the relevant performance targets for Dr. Chen and his 2017 bonus was paid in cash.

For fiscal 2018, Mr. West was eligible to receive a bonus at an annual target of 50% of salary earned during the year. For fiscal 2018, Dr. Chen was eligible to receive a bonus at an annual target of 30% of salary earned during the year.

Employment Agreements

We have entered into an employment agreement or offer letter with each of our named executive officers. In June 2019, we entered into revised employment agreements with each of our named executive officers setting forth the terms and conditions of such executive's employment with us. In addition, each of our named executive officers has executed our standard confidential information and invention assignment agreement. Any potential payments and benefits due upon a termination of employment or change in control are described and quantified below in "—Potential Payments upon Termination or Change in Control."

John West

We entered into an initial employment agreement with Mr. West, our Chief Executive Officer, dated August 3, 2011, which set forth the initial terms and conditions of his employment with us. In June 2019, we entered into a revised employment agreement with Mr. West, which replaced and superseded Mr. West's prior employment agreement. Pursuant to the new agreement, Mr. West's base salary is $500,000 per year. Mr. West is also eligible to participate in our annual bonus plan, as adopted by our board of directors, with a bonus of up to 70% of his base salary, and a target bonus amount equal to 40% of his annual base salary at target levels of performance. In addition, Mr. West is eligible to receive long-term and short-term disability coverage in an amount of at least $179,375 in annual benefits.

Finally, Mr. West is eligible to receive a long term bonus within 60 days following the date on which the Company reaches a valuation of $1 billion or greater (as determined by (i) the average closing price per share over the trailing 30 calendar days multiplied by (ii) the number of outstanding shares of the applicable class of publicly traded stock, as calculated on a fully diluted basis), subject to his continued employment through such time. If triggered by such a valuation event, Mr. West's long term bonus is payable in shares of common stock having an aggregate grant date fair value equal to 1% of the difference between (A) the valuation of the Company (as determined by the formula described above) and (B) the aggregate gross proceeds to us, before deducting any underwriting discounts or commission or expenses payable by us, from the sale and issuance of equity securities, including this offering, from our inception through the date of the valuation event. Mr. West's employment is at will and may be terminated at any time, with or without cause.

Clinton Musil

We entered into an initial offer letter with Mr. Musil, our Chief Business Officer, dated December 14, 2018, which set forth the initial terms and conditions of his employment with us. In June 2019, we entered into an employment agreement with Mr. Musil, which replaced and superseded Mr. Musil's prior offer letter. Pursuant to the new agreement, Mr. Musil's base salary is $325,000 per year. Mr. Musil is also eligible to participate in our annual bonus plan, as adopted by our board of directors, with a bonus target of 30% of his base salary. Mr. Musil's employment is at will and may be terminated at any time, with or without cause.

Richard Chen, M.D., M.S.

We entered into an initial offer letter with Dr. Chen, our Chief Scientific Officer, dated November 23, 2011, which set forth the initial terms and conditions of his employment with us. In June 2019, we entered into an

employment agreement with Dr. Chen, which replaced and superseded Dr. Chen's prior offer letter. Pursuant to the new agreement, Dr. Chen's base salary is $400,001 per year. Dr. Chen is also eligible to participate in our annual bonus plan, as adopted by our board of directors, with a bonus target of 30% of his base salary. Dr. Chen's employment is at will and may be terminated at any time, with or without cause.

Potential Payments upon Termination or Change in Control

Regardless of the manner in which a named executive officer's service terminates, each named executive officer is entitled to receive amounts earned during his or her term of service, including unpaid salary and unused vacation.

We have entered into an agreement with each of our named executive officers with respect to potential payments and benefits due upon a termination of employment or change in control. In June 2019 we entered into revised executive severance agreements with each of our named executive officers setting forth the terms and conditions of such potential payments and benefits due upon a termination of employment or change in control.

John West

If Mr. West's long term bonus is not previously triggered by a valuation event (as described above under "—Employment Agreements—John West") and a "change in control" (as defined in his new employment agreement) occurs, then, subject to his continued employment through such time, Mr. West is eligible to receive a long term bonus within 60 days of the effective date of the change in control. In such instance, the long term bonus will be 1% of the difference between (A) the net present value for financial accounting purposes, calculated at closing of the change in control, of the "total consideration" as defined in his new employment agreement and as reasonably determined by our board of directors, and (B) the aggregate gross proceeds to us, before deducting any underwriting discounts or commission or expenses payable by us, from the sale and issuance of equity securities, including this offering, from our inception through the date of the change in control event. If triggered by a change in control, Mr. West's long term bonus is payable in the same mix of cash, securities and other property as received by other stockholders in such change in control.

Mr. West is also entitled to accelerated vesting for each of his then-outstanding unvested equity awards that would have vested within the next 12 months if a "change in control" (as defined in his new employment terms letter) occurs during his employment with us.

Mr. West's executive severance agreement provides that if Mr. West's employment is terminated by us without "cause" (and other than as a result of his death or disability) or by Mr. West for "good reason" (each as defined in the executive severance agreement), then he will be entitled to 12 months of his then-current base salary, up to 12 months of payment of COBRA premiums for himself and his eligible dependents (or a taxable monthly payment in lieu of such payment), and accelerated vesting for each of his then-outstanding unvested equity awards that would have vested within 24 months of the date of his termination of employment, all subject to the timely execution of an effective release.

Clinton Musil

Mr. Musil's executive severance agreement provides that if Mr. Musil's employment is terminated by us without "cause" (and other than as a result of his death or disability) or by Mr. Musil for "good reason" (each as defined in the executive severance agreement), in either case within 12 months after a "change in control" (as defined in the executive severance agreement), then he will be entitled to 9 months of his then-current base salary, up to 9 months of payment of COBRA premiums for himself and his eligible dependents (or a taxable monthly payment in lieu of such payment), and 100% acceleration of the unvested portions of any of his then-outstanding equity awards, all subject to the timely execution of an effective release.

Richard Chen, M.D., M.S.

Dr. Chen's executive severance agreement provides that if Dr. Chen's employment is terminated by us without "cause" (and other than as a result of his death or disability) or by Dr. Chen for "good reason" (each as defined in the executive severance agreement), in either case within 12 months after a "change in control" (as defined in the executive severance agreement), then he will be entitled to 9 months of his then-current base salary, up to 9 months of payment of COBRA premiums for himself and his eligible dependents (or a taxable monthly payment in lieu of such payment), and 100% acceleration of the unvested portions of any of his then-outstanding equity awards, all subject to the timely execution of an effective release.

In addition, each of our named executive officers' stock options are subject to the terms of the 2011 Plan and form of share option agreement thereunder. A description of the termination and change in control provisions in the 2011 Plan and stock options granted thereunder is provided below under "—Equity Incentive Plans."

Outstanding Equity Awards as of December 31, 2018

The following table presents the outstanding equity incentive plan awards held by each named executive officer as of December 31, 2018.

	Option Awards(1)				
Name	Grant Date	Number of Securities Underlying Unexercised Options Exercisable	Number of Securities Underlying Unexercised Options Unexercisable	Option Exercise Price Per Share(2)	Option Expiration Date
John West	3/7/2012(3)	562,500	—	$ 0.44	3/7/2022
	11/13/2013(3)	187,500	—	1.84	11/13/2023
	12/11/2013(3)	64,430	—	1.84	12/11/2023
	3/12/2014(3)	45,061	—	1.84	3/12/2024
	4/15/2015(3)	15,015	—	5.04	4/15/2025
	5/11/2016(3)	15,000	—	2.84	5/11/2026
	5/24/2017(4)	98,958	151,042	2.44	5/24/2027
	7/26/2017(3)	15,000	—	2.44	7/26/2027
	4/25/2018(3)	25,000	—	3.80	4/25/2028
	4/25/2018(5)	27,777	97,223	3.80	4/25/2028
	12/24/2018(6)	—	150,000	7.32	12/24/2028
Clinton Musil	12/24/2018(7)	—	255,839	7.32	12/24/2028
Richard Chen, M.D., M.S.	3/7/2012(3)	289,250	—	0.44	3/7/2022
	11/13/2013(3)	55,000	—	1.84	11/13/2023
	5/24/2017(8)	39,583	60,417	2.44	5/24/2027
	4/25/2018(9)	8,333	29,167	3.80	4/25/2028
	12/14/2018(10)	—	62,500	7.32	12/14/2028

(1) All of the option awards were granted under the 2011 Plan, the terms of which plan is described below under "—Equity Incentive Plans."
(2) All of the option awards were granted with a per share exercise price equal to the fair market value of one share of our common stock on the date of grant, as determined in good faith by our board of directors or compensation committee.
(3) Fully vested as of December 31, 2018.
(4) The shares subject to the option vest in 48 equal monthly installments measured from May 1, 2017, subject to continuous service as of each such vesting date.
(5) The shares subject to the option vest in 36 equal monthly installments measured from May 1, 2018, subject to continuous service as of each such vesting date.

(6) The shares subject to the option vest in 48 equal monthly installments measured from December 14, 2018, subject to continuous service as of each such vesting date.
(7) 20% of the shares subject to the option vest upon the closing of this offering, 20% of the shares subject to the option vest on December 17, 2019, and the remaining shares vest in 36 equal monthly installments thereafter, subject to continuous service as of each such vesting date.
(8) The shares subject to the option vest in 48 equal monthly installments measured from May 1, 2017, subject to continuous service as of each such vesting date.
(9) The shares subject to the option vest in 36 equal monthly installments measured from May 1, 2018, subject to continuous service as of each such vesting date.
(10) The shares subject to the option vest in 48 equal monthly installments measured from December 14, 2018, subject to continuous service as of each such vesting date.

Other Compensation and Benefits

All of our current named executive officers are eligible to participate in our employee benefit plans, including our medical, dental, vision, life, disability, and accidental death and dismemberment insurance plans, in each case on the same basis as all of our other employees. We pay the premiums for the life, disability, and accidental death and dismemberment insurance for all of our employees, including our named executive officers. We generally do not provide perquisites or personal benefits to our named executive officers.

Our named executive officers did not participate in, or earn any benefits under, any nonqualified deferred compensation plan sponsored by us during the fiscal year ended December 31, 2018. Our board of directors may elect to provide our officers and other employees with nonqualified deferred compensation benefits in the future if it determines that doing so is in our best interests.

Our named executive officers did not participate in, or otherwise receive any benefits under, any pension or retirement plan sponsored by us during fiscal 2018.

Employee Benefit and Stock Plans

The principal features of our equity incentive plans and 401(k) plan are summarized below. These summaries are qualified in their entirety by reference to the actual text of the plans, which, other than the 401(k) plan, are filed as exhibits to the registration statement of which this prospectus is a part.

2019 Equity Incentive Plan

Our board of directors adopted and our stockholders approved our 2019 Equity Incentive Plan (the "2019 Plan") in May 2019 and June 2019, respectively. The 2019 Plan became effective immediately prior to the execution of the underwriting agreement related to this offering, and no further grants will be made under the 2011 Plan. No stock awards have yet been granted under the 2019 Plan.

Stock Awards. The 2019 Plan provides for the grant of incentive stock options ("ISOs") within the meaning of Section 422 of the Code, nonstatutory stock options ("NSOs"), stock appreciation rights, restricted stock awards, restricted stock unit awards, performance-based stock awards, and other forms of equity compensation, which are collectively referred to as stock awards. Additionally, the 2019 Plan provides for the grant of performance cash awards. ISOs may be granted only to our employees and to any of our parent or subsidiary corporation's employees. All other awards may be granted to employees, including officers, and to non-employee directors and consultants of ours and any of our affiliates.

Share Reserve. Initially, the aggregate number of shares of our common stock that may be issued pursuant to stock awards under the 2019 Plan is 7,440,524 shares, which number is the sum of (i) 2,000,000 shares plus (ii) the number of shares reserved, and remaining available for issuance, under our 2011 Plan at the time our

2019 Plan became effective and (iii) the number of shares subject to stock options or other stock awards granted under our 2011 Plan that would have otherwise returned to our 2011 Plan (such as upon the expiration or termination of a stock award prior to vesting). The number of shares of our common stock reserved for issuance under our 2019 Plan will automatically increase on January 1 of each year, beginning on January 1, 2020 and continuing through and including January 1, 2029, by 5% of the total number of shares of our capital stock outstanding on December 31 of the preceding calendar year, or a lesser number of shares determined by our board of directors. The maximum number of shares that may be issued upon the exercise of ISOs under our 2019 Plan is three times the share reserve, or 22,321,572 shares.

If a stock award granted under the 2019 Plan expires or otherwise terminates without being exercised in full, or is settled in cash, the shares of our common stock not acquired pursuant to the stock award again will become available for subsequent issuance under the 2019 Plan. In addition, the following types of shares under the 2019 Plan may become available for the grant of new stock awards under the 2019 Plan: (1) shares that are forfeited to or repurchased by us prior to becoming fully vested; (2) shares withheld to satisfy income or employment withholding taxes; or (3) shares used to pay the exercise or purchase price of a stock award. Shares issued under the 2019 Plan may be previously unissued shares or reacquired shares bought by us on the open market.

The maximum number of shares of common stock subject to stock awards granted under the 2019 Plan or otherwise during any one calendar year to any non-employee director, taken together with any cash fees paid by us to such non-employee director during such calendar year for service on the board of directors, will not exceed $750,000 in total value (calculating the value of any such stock awards based on the grant date fair value of such stock awards for financial reporting purposes), or, with respect to the calendar year in which a non-employee director is first appointed or elected to our board of directors, $900,000.

Administration. Our board of directors, or a duly authorized committee thereof, has the authority to administer the 2019 Plan. Our board of directors may also delegate to one or more of our officers the authority to (1) designate employees (other than other officers) to be recipients of certain stock awards, (2) determine the number of shares of common stock to be subject to such stock awards, and (3) specify the other terms and conditions, including the strike price or purchase price and vesting schedule, applicable to such awards. Subject to the terms of the 2019 Plan, our board of directors or the authorized committee, referred to as the plan administrator, determines recipients, dates of grant, the numbers and types of stock awards to be granted, and the terms and conditions of the stock awards, including the period of their exercisability and the vesting schedule applicable to a stock award. Subject to the limitations set forth below, the plan administrator will also determine the exercise price, strike price, or purchase price of stock awards granted and the types of consideration to be paid for the stock award.

The plan administrator has the authority to modify outstanding stock awards under our 2019 Plan. Subject to the terms of our 2019 Plan, the plan administrator has the authority, without stockholder approval, to reduce the exercise, purchase, or strike price of any outstanding stock award, cancel any outstanding stock award in exchange for new stock awards, cash, or other consideration, or take any other action that is treated as a repricing under generally accepted accounting principles, with the consent of any adversely affected participant.

Stock Options. ISOs and NSOs are evidenced by stock option agreements adopted by the plan administrator. The plan administrator determines the exercise price for a stock option, within the terms and conditions of the 2019 Plan, provided that the exercise price of a stock option generally cannot be less than 100% of the fair market value of our common stock on the date of grant. Options granted under the 2019 Plan vest at the rate specified by the plan administrator.

The plan administrator determines the term of stock options granted under the 2019 Plan, up to a maximum of 10 years. Unless the terms of an option holder’s stock option agreement provide otherwise, if an option holder’s service relationship with us, or any of our affiliates, ceases for any reason other than disability, death, or cause, the option holder may generally exercise any vested options for a period of three months following the

cessation of service. The option term will automatically be extended in the event that exercise of the option following such a termination of service is prohibited by applicable securities laws or our insider trading policy. If an option holder's service relationship with us or any of our affiliates ceases due to disability or death, or an option holder dies within a certain period following cessation of service, the option holder or a beneficiary may generally exercise any vested options for a period of 12 months in the event of disability and 18 months in the event of death. In the event of a termination for cause, options generally terminate immediately. In no event may an option be exercised beyond the expiration of its term.

Acceptable consideration for the purchase of common stock issued upon the exercise of a stock option will be determined by the plan administrator and may include (1) cash, check, bank draft or money order, (2) a broker-assisted cashless exercise, (3) the tender of shares of our common stock previously owned by the option holder, (4) a net exercise of the option if it is an NSO, and (5) other legal consideration approved by the plan administrator.

Unless the plan administrator provides otherwise, options generally are not transferable except by will, the laws of descent and distribution, or pursuant to a domestic relations order. An option holder may designate a beneficiary, however, who may exercise the option following the option holder's death.

Tax Limitations on ISOs. The aggregate fair market value, determined at the time of grant, of our common stock with respect to ISOs that are exercisable for the first time by an option holder during any calendar year under all of our stock plans may not exceed $100,000. Options or portions thereof that exceed such limit will be treated as NSOs. No ISOs may be granted to any person who, at the time of the grant, owns or is deemed to own stock possessing more than 10% of our total combined voting power or that of any of our parent or subsidiary corporations, unless (1) the option exercise price is at least 110% of the fair market value of the stock subject to the option on the date of grant and (2) the term of the ISO does not exceed five years from the date of grant.

Restricted Stock Awards. Restricted stock awards are evidenced by restricted stock award agreements adopted by the plan administrator. Restricted stock awards may be granted in consideration for (1) cash, check, bank draft, or money order, (2) services rendered to us or our affiliates, or (3) any other form of legal consideration. Common stock acquired under a restricted stock award may, but need not, be subject to a share repurchase option in our favor in accordance with a vesting schedule as determined by the plan administrator. Rights to acquire shares under a restricted stock award may be transferred only upon such terms and conditions as set by the plan administrator. Except as otherwise provided in the applicable award agreement, restricted stock awards that have not vested will be forfeited upon the participant's cessation of continuous service for any reason.

Restricted Stock Unit Awards. Restricted stock unit awards are evidenced by restricted stock unit award agreements adopted by the plan administrator. Restricted stock unit awards may be granted in consideration for any form of legal consideration or for no consideration. A restricted stock unit award may be settled by cash, delivery of stock, a combination of cash and stock as deemed appropriate by the plan administrator, or in any other form of consideration set forth in the restricted stock unit award agreement. Additionally, dividend equivalents may be credited in respect of shares covered by a restricted stock unit award. Rights under a restricted stock unit award may be transferred only upon such terms and conditions as set by the plan administrator. Restricted stock unit awards may be subject to vesting as determined by the plan administrator. Except as otherwise provided in the applicable award agreement, restricted stock units that have not vested will be forfeited upon the participant's cessation of continuous service for any reason.

Stock Appreciation Rights. Stock appreciation rights are evidenced by stock appreciation grant agreements adopted by the plan administrator. The plan administrator determines the strike price for a stock appreciation right, which generally cannot be less than 100% of the fair market value of our common stock on the date of grant. Upon the exercise of a stock appreciation right, we will pay the participant an amount in cash or stock equal to (1) the excess of the per share fair market value of our common stock on the date of exercise over the

strike price, multiplied by (2) the number of shares of common stock with respect to which the stock appreciation right is exercised. A stock appreciation right granted under the 2019 Plan vests at the rate specified in the stock appreciation right agreement as determined by the plan administrator.

The plan administrator determines the term of stock appreciation rights granted under the 2019 Plan, up to a maximum of 10 years. Unless the terms of a participant's stock appreciation right agreement provides otherwise, if a participant's service relationship with us or any of our affiliates ceases for any reason other than cause, disability, or death, the participant may generally exercise any vested stock appreciation right for a period of three months following the cessation of service. The stock appreciation right term will be further extended in the event that exercise of the stock appreciation right following such a termination of service is prohibited by applicable securities laws. If a participant's service relationship with us, or any of our affiliates, ceases due to disability or death, or a participant dies within a certain period following cessation of service, the participant or a beneficiary may generally exercise any vested stock appreciation right for a period of 12 months in the event of disability and 18 months in the event of death. In the event of a termination for cause, stock appreciation rights generally terminate immediately upon the occurrence of the event giving rise to the termination of the individual for cause. In no event may a stock appreciation right be exercised beyond the expiration of its term.

Unless the plan administrator provides otherwise, stock appreciation rights generally are not transferable except by will, the laws of descent and distribution, or pursuant to a domestic relations order. A stock appreciation right holder may designate a beneficiary, however, who may exercise the stock appreciation right following the holder's death.

Performance Awards. Our 2019 Plan permits the grant of performance-based stock and cash awards. The performance goals that may be selected include one or more of the following: (1) earnings (including earnings per share and net earnings); (2) earnings before interest, taxes, and depreciation; (3) earnings before interest, taxes, depreciation, and amortization; (4) total stockholder return; (5) return on equity or average stockholder's equity; (6) return on assets, investment, or capital employed; (7) stock price; (8) margin (including gross margin); (9) income (before or after taxes); (10) operating income; (11) operating income after taxes; (12) pre-tax profit; (13) operating cash flow; (14) sales or revenue targets; (15) increases in revenue or product revenue; (16) expenses and cost reduction goals; (17) improvement in or attainment of working capital levels; (18) economic value added (or an equivalent metric); (19) market share; (20) cash flow; (21) cash flow per share; (22) share price performance; (23) debt reduction; (24) customer satisfaction; (25) stockholders' equity; (26) capital expenditures; (27) debt levels; (28) operating profit or net operating profit; (29) workforce diversity; (30) growth of net income or operating income; (31) billings; (32) implementation or completion of projects or processes; (33) financing; (34) regulatory milestones; (35) stockholder liquidity; (36) corporate governance and compliance; (37) product commercialization; (38) intellectual property; (39) personnel matters; (40) progress of internal research or clinical programs; (41) progress of partnered programs; (42) partner satisfaction; (43) budget management; (44) clinical achievements; (45) completing phases of a clinical study (including the treatment phase); (46) announcing or presenting preliminary or final data from clinical studies, in each case, whether on particular timelines or generally; (47) timely completion of clinical trials; (48) submission of Device Master File(s) and other regulatory achievements; (49) partner or collaborator achievements; (50) internal controls, including those related to the Sarbanes-Oxley Act of 2002; (51) research progress, including the development of programs; (52) investor relations, analysts, and communication; (53) manufacturing achievements (including obtaining particular yields from manufacturing runs and other measurable objectives related to process development activities); (54) strategic partnerships or transactions (including in-licensing and out-licensing of intellectual property); (55) establishing relationships with commercial entities with respect to the marketing, distribution and sale of our products and services (including with group purchasing organizations, distributors and other vendors); (56) supply chain achievements (including establishing relationships with manufacturers, suppliers and other services providers of our products and services); (57) co-development, co-marketing, profit sharing, joint venture, or other similar arrangements; (58) individual performance goals; (59) corporate development and planning goals; and (60) other measures of performance selected by our board of directors or any committee thereof.

The performance goals may be based on company-wide performance or performance of one or more business units, divisions, affiliates, or business segments, and may be either absolute or relative to the performance of one or more comparable companies or the performance of one or more relevant indices. Unless specified otherwise in the award agreement at the time the award is granted or in such other document setting forth the performance goals at the time the goals are established, we will appropriately make adjustments in the method of calculating the attainment of performance goals as follows: (1) to exclude restructuring and/or other nonrecurring charges; (2) to exclude exchange rate effects; (3) to exclude the effects of changes to generally accepted accounting principles; (4) to exclude the effects of any statutory adjustments to corporate tax rates; (5) to exclude the effects of any items that are unusual in nature or occur infrequently as determined under generally accepted accounting principles; (6) to exclude the dilutive effects of acquisitions or joint ventures; (7) to assume that any business divested by us achieved performance objectives at targeted levels during the balance of a performance period following such divestiture; (8) to exclude the effect of any change in the outstanding shares of our common stock by reason of any stock dividend or split, stock repurchase, reorganization, recapitalization, merger, consolidation, spin-off, combination or exchange of shares, or other similar corporate change, or any distributions to common stockholders other than regular cash dividends; (9) to exclude the effects of stock-based compensation and the award of bonuses under our bonus plans; (10) to exclude costs incurred in connection with potential acquisitions or divestitures that are required to be expensed under generally accepted accounting principles; (11) to exclude the goodwill and intangible asset impairment charges that are required to be recorded under generally accepted accounting principles; and (12) to exclude the effect of any other unusual, nonrecurring gain or loss or other extraordinary item. In addition, we retain the discretion to adjust or eliminate the compensation or economic benefit due upon attainment of the goals. The performance goals may differ from participant to participant and from award to award.

Other Stock Awards. The plan administrator may grant other awards based in whole or in part by reference to our common stock. The plan administrator will set the number of shares under the stock award and all other terms and conditions of such awards.

Changes to Capital Structure. In the event that there is a specified type of change in our capital structure, such as a stock split or recapitalization, appropriate adjustments will be made to (1) the class and maximum number of shares reserved for issuance under the 2019 Plan, (2) the class and maximum number of shares by which the share reserve may increase automatically each year, (3) the class and number of shares that may be issued upon the exercise of ISOs, and (4) the class and number of shares and exercise price, strike price, or purchase price, if applicable, of all outstanding stock awards.

Corporate Transactions. In the event of certain specified significant corporate transactions, the plan administrator has the discretion to take any of the following actions with respect to stock awards:

- arrange for the assumption, continuation, or substitution of a stock award by a surviving or acquiring entity or parent company;
- arrange for the assignment of any reacquisition or repurchase rights held by us to the surviving or acquiring entity or parent company;
- accelerate the vesting of the stock award and provide for its termination prior to the effective time of the corporate transaction;
- arrange for the lapse of any reacquisition or repurchase right held by us;
- cancel or arrange for the cancellation of the stock award in exchange for such cash consideration, if any, as our board of directors may deem appropriate; or
- make a payment equal to the excess of (1) the value of the property the participant would have received upon exercise of the stock award over (2) the exercise price or strike price otherwise payable in connection with the stock award.

Our plan administrator is not obligated to treat all stock awards, even those that are of the same type, in the same manner.

Under the 2019 Plan, a significant corporate transaction is generally the consummation of (1) a sale or other disposition of all or substantially all of our consolidated assets, (2) a sale or other disposition of at least 50% of our outstanding securities, (3) a merger, consolidation or similar transaction following which we are not the surviving corporation, or (4) a merger, consolidation, or similar transaction following which we are the surviving corporation but the shares of our common stock outstanding immediately prior to such transaction are converted or exchanged into other property by virtue of the transaction.

Change in Control. The plan administrator may provide, in an individual award agreement or in any other written agreement between a participant and us, that the stock award will be subject to additional acceleration of vesting and exercisability or settlement in the event of a change in control. Under the 2019 Plan, a change in control is generally (1) the acquisition by a person or entity of more than 50% of our combined voting power other than by merger, consolidation or similar transaction, (2) a consummated merger, consolidation, or similar transaction immediately after which our stockholders do not own more than 50% of the combined voting power of the surviving entity (or its parent company), (3) a consummated sale, lease or exclusive license or other disposition of all or substantially all of our consolidated assets, and (4) certain dissolutions, liquidations and changes in the board of directors.

Amendment and Termination. Our board of directors has the authority to amend, suspend, or terminate our 2019 Plan, provided that such action does not materially impair the existing rights of any participant without such participant's written consent and provided further that certain types of amendments will require the approval of our stockholders. No ISOs may be granted after the tenth anniversary of the date our board of directors adopts our 2019 Plan.

2019 Employee Stock Purchase Plan

Our board of directors adopted the 2019 Employee Stock Purchase Plan (the "ESPP") in May 2019, and our stockholders approved the ESPP in June 2019. The ESPP became effective upon the date of the underwriting agreement related to this offering. The purpose of the ESPP is to secure the services of new employees, to retain the services of existing employees and to provide incentives for such individuals to exert maximum efforts toward our success and that of our affiliates. The ESPP is intended to qualify as an "employee stock purchase plan" within the meaning of Section 423 of the Code.

Share Reserve. Following this offering, the ESPP will authorize the issuance of 250,000 shares of our common stock pursuant to purchase rights granted to our employees or to employees of any of our designated affiliates. The number of shares of our common stock reserved for issuance will automatically increase on January 1 of each calendar year, from January 1, 2020 (assuming the ESPP becomes effective in 2019) through January 1, 2029, by the lesser of (1) 1% of the total number of shares of our common stock outstanding on December 31 of the preceding calendar year, and (2) 500,000 shares; *provided*, that prior to the date of any such increase, our board of directors may determine that such increase will be less than the amount set forth in clauses (1) and (2).

Administration. Our board of directors intends to delegate concurrent authority to administer the ESPP to our compensation committee. The ESPP is implemented through a series of offerings under which eligible employees are granted purchase rights to purchase shares of our common stock on specified dates during such offerings. Under the ESPP, we may specify offerings with durations of not more than 27 months, and may specify shorter purchase periods within each offering. Each offering will have one or more purchase dates on which shares of our common stock will be purchased for employees participating in the offering. An offering under the ESPP may be terminated under certain circumstances.

Payroll Deductions. Generally, all regular employees, including executive officers, employed by us or by any of our designated affiliates, may participate in the ESPP and may contribute, normally through payroll deductions, up to 15% of their earnings (as defined in the ESPP) for the purchase of our common stock under the ESPP. Unless otherwise determined by our board of directors, common stock will be purchased for the accounts of employees participating in the ESPP at a price per share equal to the lower of (a) 85% of the fair market value of a share of our common stock on the first trading date of an offering or (b) 85% of the fair market value of a share of our common stock on the date of purchase.

Limitations. Employees may have to satisfy one or more of the following service requirements before participating in the ESPP, as determined by our board of directors, including: (1) being customarily employed for more than 20 hours per week; (2) being customarily employed for more than five months per calendar year; or (3) continuous employment with us or one of our affiliates for a period of time (not to exceed two years). No employee may purchase shares under the ESPP at a rate in excess of $25,000 worth of our common stock based on the fair market value per share of our common stock at the beginning of an offering for each year such a purchase right is outstanding. Finally, no employee will be eligible for the grant of any purchase rights under the ESPP if immediately after such rights are granted, such employee has voting power over 5% or more of our outstanding capital stock measured by vote or value pursuant to Section 424(d) of the Code.

Changes to Capital Structure. In the event that there occurs a change in our capital structure through such actions as a stock split, merger, consolidation, reorganization, recapitalization, reincorporation, stock dividend, dividend in property other than cash, large nonrecurring cash dividend, liquidating dividend, combination of shares, exchange of shares, change in corporate structure, or similar transaction, the board of directors will make appropriate adjustments to (1) the number of shares reserved under the ESPP, (2) the maximum number of shares by which the share reserve may increase automatically each year, (3) the number of shares and purchase price of all outstanding purchase rights, and (4) the number of shares that are subject to purchase limits under ongoing offerings.

Corporate Transactions. In the event of certain significant corporate transactions, including (1) a sale of all or substantially all of our assets, (2) the sale or disposition of 50% of our outstanding securities, (3) the consummation of a merger or consolidation where we do not survive the transactions, and (4) the consummation of a merger or consolidation where we do survive the transaction but the shares of our common stock outstanding immediately prior to such transaction are converted or exchanged into other property by virtue of the transaction, any then-outstanding rights to purchase our stock under the ESPP may be assumed, continued, or substituted for by any surviving or acquiring entity (or its parent company). If the surviving or acquiring entity (or its parent company) elects not to assume, continue, or substitute for such purchase rights, then the participants' accumulated payroll contributions will be used to purchase shares of our common stock within 10 business days prior to such corporate transaction, and such purchase rights will terminate immediately.

ESPP Amendments, Termination. Our board of directors has the authority to amend or terminate our ESPP, provided that except in certain circumstances such amendment or termination may not materially impair any outstanding purchase rights without the holder's consent. We will obtain stockholder approval of any amendment to our ESPP, as required by applicable law or listing requirements.

2011 Equity Incentive Plan

Our board of directors adopted our 2011 Plan in October 2011, and our stockholders approved our 2011 Plan in November 2011. Our 2011 Plan has been periodically amended, most recently in February 2019. Our 2011 Plan will be terminated prior to the closing of this offering, and thereafter we will not grant any additional awards under our 2011 Plan. However, our 2011 Plan will continue to govern the terms and conditions of the outstanding awards previously granted thereunder, which include options and restricted stock awards.

Share Reserve. As of March 31, 2019, stock options covering 4,381,884 shares with a weighted-average exercise price of $3.62 per share were outstanding, and 1,068,799 shares of our common stock remained

available for the future grant of awards under our 2011 Plan. Any shares of our common stock remaining available for issuance under our 2011 Plan at the time our 2019 Plan becomes effective will become available for issuance under our 2019 Plan. In addition, any shares subject to options that expire or terminate prior to exercise or are withheld to satisfy tax withholding obligations with respect to or the exercise price of an option, and any shares of restricted stock that are forfeited to or repurchased by us due to failure to vest, will be added to the number of shares then available for issuance under our 2019 Plan.

Administration. Our board of directors or a committee delegated by our board of directors administers our 2011 Plan. Subject to the terms of our 2011 Plan, the administrator has the power to, among other things, determine who will be granted awards, to determine the terms and conditions of each award (including the number of shares, exercise price, if any, and any vesting conditions), to lower or reduce the exercise price of outstanding options, to accelerate the time(s) when an award may vest or be exercised, and to construe and interpret the terms of our 2011 Plan and awards granted thereunder.

Options and Restricted Stock. Options and restricted stock granted under our 2011 Plan are subject to terms and conditions generally similar to those described above with respect to options and restricted stock that may be granted under our 2019 Plan.

Changes to Capital Structure. In the event that there is a specified type of change in our capital structure, such as a stock split or recapitalization, appropriate adjustments will be made to (1) the class and maximum number of shares reserved for issuance under the 2011 Plan, (2) the class and maximum number of shares that may be issued upon the exercise of ISOs, and (3) the class and number of shares and price per share, if applicable, of all outstanding awards.

Corporate Transactions. In the event of certain specified significant corporate transactions, the administrator has the discretion to take any of the following actions with respect to awards:

- arrange for the assumption, continuation, or substitution of an award by a surviving or acquiring entity or parent company;
- arrange for the assignment of any reacquisition or repurchase rights held by us to the surviving or acquiring entity or parent company;
- accelerate the vesting of the award and provide for its termination prior to the effective time of the corporate transaction;
- arrange for the lapse of any reacquisition or repurchase right held by us;
- cancel or arrange for the cancellation of the award in exchange for such cash consideration, if any, as our board of directors may deem appropriate; or
- make a payment equal to the excess of (1) the value of the property the participant would have received upon exercise of the award over (2) the exercise price payable in connection with the award.

The administrator is not obligated to treat all awards, even those that are of the same type, in the same manner.

Under our 2011 Plan, a significant corporate transaction is generally the consummation of (1) a sale or other disposition of all or substantially all of our consolidated assets, (2) a sale or other disposition of at least 90% of our outstanding securities, (3) a merger, consolidation or similar transaction following which we are not the surviving corporation, or (4) a merger, consolidation or similar transaction following which we are the surviving corporation but the shares of our common stock outstanding immediately prior to such transaction are converted or exchanged into other property by virtue of the transaction.

Change in Control. The administrator may provide, in an individual award agreement or in any other written agreement between a participant and us that the award will be subject to additional acceleration of vesting and

exercisability upon or after a change in control. Under our 2011 Plan, a change in control is generally (1) the acquisition by a person or entity of more than 50% of our combined voting power other than by merger, consolidation or similar transaction, (2) a consummated merger, consolidation or similar transaction immediately after which our stockholders do not own more than 50% of the combined voting power of the surviving entity (or its parent company), (3) a consummated sale, lease or exclusive license or other disposition of all or substantially all of our consolidated assets, and (4) certain changes in our board of directors.

Plan Amendment or Termination. Our board of directors may amend, alter, suspend or terminate our 2011 Plan at any time, subject to stockholder approval to the extent required by applicable law. No amendment to our 2011 Plan may impair the rights of any award holder unless mutually agreed otherwise between the award holder and us. As discussed above, we will terminate our 2011 Plan prior to the closing of this offering and no new awards will be granted thereunder following such termination.

401(k) Plan

We maintain a 401(k) plan that provides eligible U.S. employees with an opportunity to save for retirement on a tax-advantaged basis. Eligible employees are able to defer eligible compensation up to certain Code limits, which are updated annually. We have the ability to make matching and discretionary contributions to the 401(k) plan. Currently, we do not make matching contributions or discretionary contributions to the 401(k) plan. The 401(k) plan is intended to be qualified under Section 401(a) of the Code, with the related trust intended to be tax exempt under Section 501(a) of the Code. As a tax-qualified retirement plan, contributions to the 401(k) plan are deductible by us when made, and contributions and earnings on those amounts are not generally taxable to the employees until withdrawn or distributed from the 401(k) plan.

Limitations of Liability and Indemnification Matters

On the closing of this offering, our amended and restated certificate of incorporation will contain provisions that limit the liability of our current and former directors for monetary damages to the fullest extent permitted by Delaware law. Delaware law provides that directors of a corporation will not be personally liable for monetary damages for any breach of fiduciary duties as directors, except liability for:

- any breach of the director's duty of loyalty to the corporation or its stockholders;
- any act or omission not in good faith or that involves intentional misconduct or a knowing violation of law;
- unlawful payments of dividends or unlawful stock repurchases or redemptions; or
- any transaction from which the director derived an improper personal benefit.

Such limitation of liability does not apply to liabilities arising under federal securities laws and does not affect the availability of equitable remedies such as injunctive relief or rescission.

Our amended and restated certificate of incorporation that will be in effect on the closing of this offering will authorize us to indemnify our directors, officers, employees, and other agents to the fullest extent permitted by Delaware law. Our amended and restated bylaws that will be in effect on the closing of this offering will provide that we are required to indemnify our directors and officers to the fullest extent permitted by Delaware law and may indemnify our other employees and agents. Our amended and restated bylaws that will be in effect on the closing of this offering will also provide that, on satisfaction of certain conditions, we will advance expenses incurred by a director or officer in advance of the final disposition of any action or proceeding, and permit us to secure insurance on behalf of any officer, director, employee, or other agent for any liability arising out of his or her actions in that capacity regardless of whether we would otherwise be permitted to indemnify him or her under the provisions of Delaware law. We have entered and expect to continue to enter into agreements to indemnify our directors and executive officers. With certain exceptions, these agreements provide for

indemnification for related expenses, including attorneys' fees, judgments, fines, and settlement amounts incurred by any of these individuals in connection with any action, proceeding, or investigation. We believe that these amended and restated certificate of incorporation and amended and restated bylaw provisions and indemnification agreements are necessary to attract and retain qualified persons as directors and officers. We also maintain customary directors' and officers' liability insurance.

The limitation of liability and indemnification provisions in our amended and restated certificate of incorporation and amended and restated bylaws may discourage stockholders from bringing a lawsuit against our directors for breach of their fiduciary duty. They may also reduce the likelihood of derivative litigation against our directors and officers, even though an action, if successful, might benefit us and other stockholders. Further, a stockholder's investment may be adversely affected to the extent that we pay the costs of settlement and damage awards against directors and officers as required by these indemnification provisions.

Insofar as indemnification for liabilities arising under the Securities Act of 1933, as amended (the "Securities Act"), may be permitted for directors, executive officers, or persons controlling us, we have been informed that, in the opinion of the SEC, such indemnification is against public policy as expressed in the Securities Act and is therefore unenforceable.

CERTAIN RELATIONSHIPS AND RELATED PARTY TRANSACTIONS

Other than compensation arrangements for our directors and executive officers, which are described elsewhere in this prospectus, below we describe transactions since January 1, 2016 and each currently proposed transaction in which:

- we have been or are to be a participant;
- the amounts involved exceeded or will exceed $120,000; and
- any of our directors, executive officers, or holders of more than 5% of our outstanding capital stock, or any immediate family member of, or person sharing the household with, any of these individuals or entities, had or will have a direct or indirect material interest.

Convertible Promissory Note Financing

In June 2017, our board of directors approved and we sold and issued $12,225,000 principal amount of convertible promissory notes to certain investors, including certain holders of more than 5% of our outstanding capital stock as set forth in the table below. The convertible promissory notes carried an 8% interest rate per annum. The notes were amended with the consent of Lightspeed Venture Partners VIII, L.P. and Abingworth Bioventures V, LP in May 2018 and August 2018. Pursuant to these amendments, in September 2018, the outstanding principal balance of and unpaid accrued interest on the notes converted into an aggregate total of 1,667,997 shares of our Series C redeemable convertible preferred stock at a price per share of $8.052, including a total of 682,207 shares that were issued to certain holders of more than 5% of our outstanding capital stock as set forth in the table below.

Stockholder	Principal Amount of Notes	Number of Conversion Shares
Entities affiliated with Lightspeed Venture Partners[1][2]	$2,179,000	297,306
Abingworth Bioventures V LP[3]	1,886,500	257,397
MDV IX, L.P., as nominee for itself and MDV ENF IX, L.P.	934,500	127,504

(1) Entities associated with Lightspeed Venture Partners holding our securities whose shares are aggregated for purposes of reporting share ownership information are Lightspeed Venture Partners Select, L.P. and Lightspeed Venture Partners VIII, L.P.

(2) Christopher Schaepe, a member of our board of directors until his resignation on March 21, 2019, was a general partner at Lightspeed Venture Partners at the time of these transactions.

(3) Vincent Miles, Ph.D., a member of our board of directors until his resignation on May 1, 2019, is a general partner at Abingworth Bioventures V LP.

Investor Rights Agreement

We are party to an amended and restated investor rights agreement (the “IRA”) with certain holders of our capital stock, including the holders of more than 5% of our outstanding capital stock, such as Lightspeed Venture Partners VIII, L.P., Lightspeed Venture Partners Select, L.P., Abingworth Bioventures V LP, MDV IX, L.P. and its affiliates, and certain affiliates of The Board of Trustees of the Leland Stanford Junior University. The IRA provides the holders of our redeemable convertible preferred stock with certain registration rights, including the right to demand that we file a registration statement or request that their shares be covered by a registration statement that we are otherwise filing. The IRA also provides these stockholders with information rights, which will terminate on the closing of this offering, and a right of first refusal with regard to certain issuances of our capital stock, which will not apply to the shares issued pursuant to this offering and which will terminate on the closing of this offering. After the closing of this offering, the holders of up to an aggregate of 18,790,983 shares of our common stock (including an aggregate of 127,598 shares issuable upon the exercise of warrants that were

outstanding as of March 31, 2019) will be entitled to rights with respect to the registration of their shares under the Securities Act under this agreement. For a description of these registration rights, see the section titled "Description of Capital Stock—Registration Rights."

Voting Agreement

We are party to an amended and restated voting agreement under which certain holders of our capital stock, including the holders of more than 5% of our outstanding capital stock, such as Lightspeed Venture Partners VIII, L.P., Lightspeed Venture Partners Select, L.P., Abingworth Bioventures V LP, MDV IX, L.P. and its affiliates, and certain affiliates of The Board of Trustees of the Leland Stanford Junior University, have agreed as to the manner in which they will vote their shares of our capital stock on certain matters, including with respect to the election of directors. Upon the closing of this offering, the amended and restated voting agreement will terminate, and none of our stockholders will have any special rights regarding the election or designation of members of our board of directors.

Directed Share Program

At our request, the underwriters have reserved up to 333,333 shares of common stock for sale at the initial public offering price through a directed share program to our non-employee directors. The directed share program will not limit the ability of our non-employee directors to purchase more than $120,000 in value of our common stock. We do not currently know the extent to which our non-employee directors will participate in our directed share program, if at all, or to the extent they will purchase more than $120,000 in value of our common stock. For additional information, see the section titled "Underwriters—Directed Share Program."

Indemnification Agreements

Our amended and restated certificate of incorporation that will be in effect on the closing of this offering will contain provisions limiting the liability of directors, and our amended and restated bylaws that will be in effect on the closing of this offering will provide that we will indemnify each of our directors and officers to the fullest extent permitted under Delaware law. Our amended and restated certificate of incorporation and amended and restated bylaws that will be in effect on the closing of this offering will also provide our board of directors with discretion to indemnify our employees and other agents when determined appropriate by the board.

In addition, we have entered into an indemnification agreement with each of our directors and executive officers, which requires us to indemnify them. For more information regarding these agreements, see the section titled "Executive Compensation—Limitations of Liability and Indemnification Matters."

Policies and Procedures for Related Person Transactions

Our board of directors has adopted a related person transaction policy setting forth the policies and procedures for the identification, review, and approval or ratification of related person transactions. This policy covers, with certain exceptions set forth in Item 404 of Regulation S-K under the Securities Act, any transaction, arrangement, or relationship, or any series of similar transactions, arrangements, or relationships, in which we and a related person were or will be participants and the amount involved exceeds $120,000, including purchases of goods or services by or from the related person or entities in which the related person has a material interest, indebtedness, and guarantees of indebtedness. In reviewing and approving any such transactions, our audit committee will consider all relevant facts and circumstances as appropriate, such as the purpose of the transaction, the availability of other sources of comparable products or services, whether the transaction is on terms comparable to those that could be obtained in an arm's length transaction, management's recommendation with respect to the proposed related person transaction, and the extent of the related person's interest in the transaction.

PRINCIPAL STOCKHOLDERS

The following table sets forth information with respect to the beneficial ownership of our capital stock as of March 31, 2019, as adjusted to reflect the sale of our common stock offered by us in this offering assuming no exercise of the underwriters' option to purchase additional shares, for:

- each of our named executive officers;
- each of our directors;
- all of our executive officers and directors as a group; and
- each person or group of affiliated persons known by us to beneficially own more than 5% of our common stock.

We have determined beneficial ownership in accordance with the rules and regulations of the SEC, and the information is not necessarily indicative of beneficial ownership for any other purpose. Except as indicated by the footnotes below, we believe, based on information furnished to us, that the persons and entities named in the table below have sole voting and sole investment power with respect to all shares that they beneficially own, subject to applicable community property laws.

Applicable percentage ownership before the offering is based on 21,829,701 shares of common stock outstanding as of March 31, 2019, assuming the automatic conversion of all outstanding shares of our redeemable convertible preferred stock into shares of common stock upon the closing of this offering and assuming the exercise of a warrant to purchase 188,643 shares of our common stock. Applicable percentage ownership after the offering is based on 29,751,201 shares of common stock outstanding immediately after the closing of this offering, assuming no exercise by the underwriters of their over-allotment option and excluding any potential purchases pursuant to the directed share program in this offering. In computing the number of shares beneficially owned by a person and the percentage ownership of such person, we deemed to be outstanding all shares subject to options held by the person that are currently exercisable, or exercisable within 60 days of March 31, 2019. However, except as described above, we did not deem such shares outstanding for the purpose of computing the percentage ownership of any other person.

Unless otherwise indicated, the address of each beneficial owner listed below is c/o Personalis, Inc., 1330 O'Brien Drive, Menlo Park, California 94025. We believe, based on information provided to us, that each of the stockholders listed below has sole voting and investment power with respect to the shares beneficially owned by the stockholder unless noted otherwise, subject to community property laws where applicable.

	Shares Beneficially Owned Prior to Offering		Shares Beneficially Owned After Offering	
Name of Beneficial Owner	Number	Percentage	Number	Percentage
5% Stockholders				
Entities affiliated with Lightspeed Venture Partners(1)	6,076,494	27.8%	6,076,494	20.4%
Abingworth Bioventures V LP(2)	5,449,294	25.0%	5,449,294	18.3%
Entities affiliated with MDV(3)	2,605,838	11.9%	2,605,838	8.8%
Entities affiliated with The Board of Trustees of the Leland Stanford Junior University(4)	1,427,219	6.5%	1,427,219	4.8%
Directors and Named Executive Officers				
John West(5)	1,615,269	7.0%	1,615,269	5.2%
Richard Chen, M.D., M.S.(6)	439,301	2.0%	439,301	1.5%
Clinton Musil(7)	51,167	*	51,167	*
Patrick Balthrop(8)	47,915	*	47,915	*
A. Blaine Bowman	—	—	—	—
Alan Colowick, M.D.	—	—	—	—

Name of Beneficial Owner	Shares Beneficially Owned Prior to Offering		Shares Beneficially Owned After Offering	
	Number	Percentage	Number	Percentage
Kenneth Ludlum(9)	49,999	*	49,999	*
Jonathan MacQuitty, Ph.D.(10)	75,000	*	75,000	*
Paul Ricci(11)	125,000	*	125,000	*
All directors and executive officers as a group (10 persons)(12)	2,403,651	10.2%	2,403,651	7.6%

* Represents beneficial ownership of less than 1%.

(1) Consists of (i) 4,117,768 shares held of record by Lightspeed Venture Partners VIII, L.P. (“Lightspeed VIII”) and (ii) 1,958,726 shares held of record by Lightspeed Venture Partners Select, L.P. (“Lightspeed Select”). Lightspeed General Partner VIII, L.P. (“Lightspeed GP”) is the general partner of Lightspeed VIII. Lightspeed Ultimate General Partner VIII, Ltd. (“Lightspeed UGP”) is the general partner of Lightspeed GP. Barry Eggers, Ravi Mhatre, and Peter Nieh are the directors of Lightspeed UGP and share voting and dispositive power with respect to the shares held by Lightspeed VIII. Lightspeed General Partner Select, L.P. (“Lightspeed Select GP”) is the general partner of Lightspeed Select. Lightspeed Ultimate General Partner Select, Ltd. (“Lightspeed Select UGP”) is the general partner of Lightspeed Select GP. Barry Eggers, Jeremy Liew, Ravi Mhatre, and Peter Nieh are the directors of Lightspeed Select UGP and share voting and dispositive power with respect to the shares held by Lightspeed Select GP. The address for these entities is 2200 Sand Hill Road, Menlo Park, California 94025.

(2) Consists of (i) 5,260,651 shares held of record by Abingworth Bioventures V, LP (“ABV V”) and Abingworth LLP (“ALLP”), the investment manager of ABV V, and (ii) 188,643 shares subject to a warrant exercisable within 60 days of March 31, 2019. Abingworth Bioventures V GP LP, a Scottish limited partnership (“ABV GP”), serves as the general partner of ABV V. Abingworth Bioventures V GP Limited, an English company (“ABV GP Limited”), serves as the general partner of ABV GP. ABV GP has delegated to ALLP all investment and dispositive power over the securities held by ABV V. An investment committee of Abingworth, composed of Timothy J. Haines, Genghis Lloyd-Harris, Kurt von Emster, Shelley Chu, and Stephen W. Bunting, approves investment and voting decisions by a majority vote, and no individual member has the sole control or voting power over the securities held by ABV V. Each of ABV GP, ABV GP Limited, ALLP, Timothy J. Haines, Genghis Lloyd-Harris, Kurt von Emster, Shelley Chu, and Stephen W. Bunting disclaims beneficial ownership of the securities held by ABV V. The address for these entities is 38 Jermyn Street, London SW1Y 6DN, United Kingdom.

(3) Consists of (i) 2,458,209 shares held of record by MDV IX, L.P. (“MDV IX”), (ii) 20,125 shares held of record by MDV ENF IX, L.P. (“ENF IX”), and (iii) 127,504 shares held of record by MDV IX, L.P., as nominee for MDV IX, L.P. and MDV ENF IX, L.P. (“IX Funds”). Ninth MDV Partners, L.L.C. is the general partner of each of MDV IX, ENF IX, and IX Funds. Jonathan Feiber and William Ericson are the managing members of Ninth MDV, LLC, and either are deemed to have sole voting and dispositive power with respect to the shares held by MDV IX, ENF IX, and IX Funds. The address for these entities is 777 Mariners Island Boulevard, Suite 550, San Mateo, California 94404.

(4) Consists of (i) 12,631 shares held of record by The Board of Trustees of the Leland Stanford Junior University (DAPER I) (“DAPER”), (ii) 98,883 shares held of record by The Board of Trustees of the Leland Stanford Junior University (OTL) (“OTL”), (iii) 1,303,074 shares held of record by The Board of Trustees of the Leland Stanford Junior University (PVF) (“PVF”), and (iv) 12,631 shares held of record by The Board of Trustees of the Leland Stanford Junior University (SBST) (“SBST”). The Board of Trustees of the Leland Stanford Junior University is the sole beneficiary of the shares held by DAPER, OTL, PVF and SBST. The address for these entities is 635 Knight Way, Stanford, California 94305.

(5) Consists of (i) 500,000 shares held of record by Mr. West and (ii) 1,115,269 shares subject to options exercisable within 60 days of March 31, 2019.

(6) Consists of (i) 25,000 shares held of record by Dr. Chen and (ii) 414,301 shares subject to options exercisable within 60 days of March 31, 2019.

(7) Consists of 51,167 shares subject to an option, which shares vest and become exercisable upon the closing of this offering, which will occur within 60 days of March 31, 2019.
(8) Consists of (i) 13,541 shares held of record by Patrick Balthrop and Mariteres Balthrop Trust, for which Mr. Balthrop is a trustee, and (ii) 34,374 shares subject to options exercisable within 60 days of March 31, 2019.
(9) Consists of (i) 45,833 shares held of record by Mr. Ludlum and (ii) 4,166 shares subject to options exercisable within 60 days of March 31, 2019.
(10) Consists of 75,000 shares subject to options exercisable within 60 days of March 31, 2019.
(11) Consists of 125,000 shares subject to options exercisable within 60 days of March 31, 2019.
(12) Consists of (i) 584,374 shares held by our current directors and executive officers, and (ii) 1,819,277 shares subject to options exercisable within 60 days of March 31, 2019.

DESCRIPTION OF CAPITAL STOCK

General

The following is a summary of the rights of our common and preferred stock and some of the provisions of our amended and restated certificate of incorporation and amended and restated bylaws, which will each become effective upon the closing of this offering, the IRA, and relevant provisions of the Delaware General Corporation Law (the "DGCL"). The descriptions herein are qualified in their entirety by our amended and restated certificate of incorporation, amended and restated bylaws, and the IRA, copies of which have been filed as exhibits to the registration statement of which this prospectus is a part, as well as the relevant provisions of the DGCL.

Upon the closing of this offering, our authorized capital stock will consist of 210,000,000 shares, all with a par value of $0.0001 per share, of which:

- 200,000,000 shares are designated as common stock; and
- 10,000,000 shares are designated as preferred stock.

Common Stock

As of March 31, 2019, there were 21,829,701 shares of our common stock outstanding and held of record by 184 stockholders, assuming the automatic conversion of all outstanding shares of our preferred stock into shares of common stock, which will automatically occur immediately prior to the closing of this offering.

Holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of stockholders, including the election of directors, and do not have cumulative voting rights. Accordingly, the holders of a majority of the outstanding shares of common stock entitled to vote in any election of directors can elect all of the directors standing for election, if they so choose, other than any directors that holders of any preferred stock we may issue may be entitled to elect. Subject to preferences that may be applicable to any then-outstanding preferred stock, holders of common stock are entitled to receive ratably those dividends, if any, as may be declared by the board of directors out of legally available funds. In the event of our liquidation, dissolution, or winding up, the holders of common stock will be entitled to share ratably in the assets legally available for distribution to stockholders after the payment of or provision for all of our debts and other liabilities, subject to the prior rights of any preferred stock then-outstanding. Holders of common stock have no preemptive or conversion rights or other subscription rights and there are no redemption or sinking funds provisions applicable to the common stock. All outstanding shares of common stock are, and the common stock to be outstanding upon the closing of this offering will be, duly authorized, validly issued, fully paid, and nonassessable. All authorized but unissued shares of our common stock will be available for issuance by our board of directors without any further stockholder action, except as required by the listing standards of Nasdaq. The rights, preferences, and privileges of holders of common stock are subject to and may be adversely affected by the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Preferred Stock

As of March 31, 2019, there were 18,474,742 shares of redeemable convertible preferred stock outstanding. Immediately upon the closing of this offering, each outstanding share of redeemable convertible preferred stock will convert into one share of common stock, and no shares of preferred stock will be outstanding.

Upon the closing of this offering, our board of directors may, without further action by our stockholders, fix the rights, preferences, privileges and restrictions of up to an aggregate of 10,000,000 shares of redeemable convertible preferred stock in one or more series and authorize their issuance. These rights, preferences, and privileges could include dividend rights, conversion rights, voting rights, terms of redemption, liquidation

preferences, sinking fund terms, and the number of shares constituting any series or the designation of such series, any or all of which may be greater than the rights of our common stock. The issuance of our redeemable convertible preferred stock could adversely affect the voting power of holders of our common stock, and the likelihood that such holders will receive dividend payments and payments upon liquidation. In addition, the issuance of preferred stock could have the effect of delaying, deferring, or preventing a change of control or other corporate action.

Options

As of March 31, 2019, we had outstanding options under our equity compensation plans to purchase an aggregate of 4,381,884 shares of our common stock with a weighted-average exercise price of $3.62 per share.

Warrants

As of March 31, 2019, we had two outstanding warrants to purchase an aggregate of up to 254,145 shares of our common stock with a weighted-average exercise price of $2.39 per share.

As of March 31, 2019, we had two outstanding warrants to purchase an aggregate of up to 84,585 shares of our preferred stock with a weighted-average exercise price of $7.13 per share. One such warrant provides for automatic, cashless exercise prior to its expiration date on September 25, 2024 under certain circumstances. Unless earlier exercised, the other warrant will expire upon the later of (i) June 28, 2024 or (ii) five years after the closing of this offering. Upon the closing of this offering and unless earlier exercised, both of these warrants will together become exercisable for up to 84,585 shares of our common stock with a weighted-average exercise price of $7.13 per share.

Registration Rights

We are party to an IRA that provides that certain stockholders, including certain holders of at least 5% of our outstanding capital stock, have certain registration rights as set forth below. The registration of shares of our common stock by the exercise of registration rights described below would enable the holders to sell these shares without restriction under the Securities Act when the applicable registration statement is declared effective. We will pay the registration expenses, other than underwriting discounts and commissions, of the shares registered pursuant to the demand, piggyback, and Form S-3 registration rights described below.

Generally, in an underwritten offering, the managing underwriter, if any, has the right, subject to specified conditions, to limit the number of shares such holders may include. The demand, piggyback, and Form S-3 registration rights described below will expire three years after the closing of this offering, of which this prospectus is a part, or with respect to any particular stockholder, at such time after the closing of this offering that such stockholder holds less than 1% of our outstanding common stock and such stockholder can sell all of its shares entitled to registration rights under Rule 144 of the Securities Act during any 90-day period.

Demand Registration Rights

The holders of up to an aggregate of 18,725,481 shares of our common stock (including 62,096 shares issuable upon the exercise of a warrant that was outstanding as of March 31, 2019) will be entitled to certain demand registration rights. At any time beginning 180 days after the closing of this offering, the holders of a majority of these shares may request that we register all or a portion of their shares. We are obligated to effect only two such registrations. Such request for registration must cover shares with an anticipated aggregate offering price, net of underwriting discounts and commissions, of at least $20 million.

Piggyback Registration Rights

In connection with this offering, the holders of an aggregate of 18,663,385 shares of our common stock were entitled to, and the necessary percentage of holders waived, their rights to notice of this offering and to

include their shares of registrable securities in this offering. After this offering, in the event that we propose to register any of our securities under the Securities Act, either for our own account or for the account of other security holders, the holders of up to an aggregate of 18,790,983 shares of our common stock (including an aggregate of 127,598 shares issuable upon the exercise of warrants that were outstanding as of March 31, 2019) will be entitled to certain piggyback registration rights allowing the holder to include their shares in such registration, subject to certain marketing and other limitations. As a result, whenever we propose to file a registration statement under the Securities Act, other than with respect to (i) a registration statement relating to any employee benefit plans, (ii) a registration relating to a corporate reorganization or other Rule 145 transaction, (iii) a registration relating to stock issued upon conversion of debt securities, or (iv) a registration on any registration form that does not permit secondary sales, the holders of these shares are entitled to notice of the registration and have the right to include their shares in the registration, subject to limitations that the underwriters may impose on the number of shares included in the offering.

Form S-3 Registration Rights

The holders of up to an aggregate of 18,725,481 shares of our common stock (including 62,096 shares issuable upon the exercise of a warrant that was outstanding as of March 31, 2019) will be entitled to certain Form S-3 registration rights. The holders of at least 20% of these shares can make a request that we register their shares on Form S-3 if we are qualified to file a registration statement on Form S-3 and if the reasonably anticipated aggregate gross proceeds of the shares offered would equal or exceed $1 million. We will not be required to effect more than two registrations on Form S-3 within any 12-month period.

Anti-Takeover Effects of Delaware Law and Our Certificate of Incorporation and Bylaws

Some provisions of Delaware law, our amended and restated certificate of incorporation, and our amended and restated bylaws contain or will contain provisions that could make the following transactions more difficult: an acquisition of us by means of a tender offer; an acquisition of us by means of a proxy contest or otherwise; or the removal of our incumbent officers and directors. It is possible that these provisions could make it more difficult to accomplish or could deter transactions that stockholders may otherwise consider to be in their best interest or in our best interests, including transactions which provide for payment of a premium over the market price for our shares.

These provisions, summarized below, are intended to discourage coercive takeover practices and inadequate takeover bids. These provisions are also designed to encourage persons seeking to acquire control of us to first negotiate with our board of directors. We believe that the benefits of the increased protection of our potential ability to negotiate with the proponent of an unfriendly or unsolicited proposal to acquire or restructure us outweigh the disadvantages of discouraging these proposals because negotiation of these proposals could result in an improvement of their terms.

Stockholder Meetings

Our amended and restated bylaws will provide that a special meeting of stockholders may be called only by our chairman of the board, chief executive officer or president, or by a resolution adopted by a majority of our board of directors.

Requirements for Advance Notification of Stockholder Nominations and Proposals

Our amended and restated bylaws will establish advance notice procedures with respect to stockholder proposals to be brought before a stockholder meeting and the nomination of candidates for election as directors, other than nominations made by or at the direction of the board of directors or a committee of the board of directors.

Elimination of Stockholder Action by Written Consent

Our amended and restated certificate of incorporation and amended and restated bylaws will eliminate the right of stockholders to act by written consent without a meeting.

Staggered Board

Our board of directors will be divided into three classes. The directors in each class will serve for a three-year term, one class being elected each year by our stockholders. For more information on the classified board, see the section titled "Management—Composition of Our Board of Directors." This system of electing and removing directors may tend to discourage a third party from making a tender offer or otherwise attempting to obtain control of us, because it generally makes it more difficult for stockholders to replace a majority of the directors.

Removal of Directors

Our amended and restated certificate of incorporation will provide that no member of our board of directors may be removed from office by our stockholders except for cause and, in addition to any other vote required by law, upon the approval of not less than two-thirds of the total voting power of all of our outstanding voting stock then entitled to vote in the election of directors.

Stockholders Not Entitled to Cumulative Voting

Our amended and restated certificate of incorporation will not permit stockholders to cumulate their votes in the election of directors. Accordingly, the holders of a majority of the outstanding shares of our common stock entitled to vote in any election of directors can elect all of the directors standing for election, if they choose, other than any directors that holders of our preferred stock may be entitled to elect.

Delaware Anti-Takeover Statute

We are subject to Section 203 of the DGCL, which prohibits persons deemed to be "interested stockholders" from engaging in a "business combination" with a publicly held Delaware corporation for three years following the date these persons become interested stockholders unless the business combination is, or the transaction in which the person became an interested stockholder was, approved in a prescribed manner or another prescribed exception applies. Generally, an "interested stockholder" is a person who, together with affiliates and associates, owns, or within three years prior to the determination of interested stockholder status did own, 15% or more of a corporation's voting stock. Generally, a "business combination" includes a merger, asset or stock sale, or other transaction resulting in a financial benefit to the interested stockholder. The existence of this provision may have an anti-takeover effect with respect to transactions not approved in advance by the board of directors.

Choice of Forum

Our amended and restated certificate of incorporation will provide that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware will be the exclusive forum for the following types of actions or proceedings under Delaware statutory or common law: (1) any derivative action or proceeding brought on our behalf; (2) any action asserting a claim of breach of a fiduciary duty or other wrongdoing by any of our directors, officers, employees, or agents to us or our stockholders; (3) any action asserting a claim against us arising pursuant to any provision of the DGCL or our certificate of incorporation or bylaws; (4) any action to interpret, apply, enforce or determine the validity of our certificate of incorporation or bylaws; or (5) any action asserting a claim governed by the internal affairs doctrine. This provision would not apply to suits brought to enforce a duty or liability created by the Exchange Act or any other claim for which the U.S. federal courts have exclusive jurisdiction. Our amended and restated certificate of incorporation further

provides that 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, subject to and contingent upon a final adjudication in the State of Delaware of the enforceability of such exclusive forum provision. Our amended and restated certificate of incorporation will also provide that any person or entity purchasing or otherwise acquiring any interest in shares of our capital stock will be deemed to have notice of and to have consented to these choice of forum provisions. It is possible that a court of law could rule that the choice of forum provisions to be contained in our amended and restated certificate of incorporation are inapplicable or unenforceable if they are challenged in a proceeding or otherwise.

Amendment of Charter Provisions

The amendment of any of the above provisions, except for the provision making it possible for our board of directors to issue preferred stock, would require approval by holders of at least two-thirds of the total voting power of all of our outstanding voting stock.

The provisions of Delaware law, our amended and restated certificate of incorporation, and our amended and restated bylaws could have the effect of discouraging others from attempting hostile takeovers and, as a consequence, they may also inhibit temporary fluctuations in the market price of our common stock that often result from actual or rumored hostile takeover attempts. These provisions may also have the effect of preventing changes in the composition of our board and management. It is possible that these provisions could make it more difficult to accomplish transactions that stockholders may otherwise deem to be in their best interests.

Transfer Agent and Registrar

The transfer agent and registrar for our common stock upon the closing of this offering will be Computershare Trust Company, N.A.

Exchange Listing

Our common stock is currently not listed on any securities exchange. We have been approved to list our common stock on The Nasdaq Global Market (“Nasdaq”) under the symbol “PSNL.”

SHARES ELIGIBLE FOR FUTURE SALE

Prior to this offering, there has been no public market for our common stock. Future sales of substantial amounts of common stock in the public market, or the perception that such sales may occur, could adversely affect the market price of our common stock. Although we have been approved to list our common stock on The Nasdaq Global Market, we cannot assure you that there will be an active public market for our common stock.

Following the closing of this offering, based on the number of shares of our common stock outstanding as of March 31, 2019 and assuming (1) the issuance of shares of common stock in this offering, (2) the conversion of all outstanding shares of our redeemable convertible preferred stock into shares of our common stock, which will automatically occur immediately prior to the closing of the offering, (3) the exercise of a warrant to purchase 188,643 shares of our common stock, and (4) no exercise of the underwriters' over-allotment option, we will have an aggregate of approximately 29,751,201 shares of common stock outstanding.

Of these shares, all shares of common stock sold in this offering will be freely tradable without restriction or further registration under the Securities Act, except for (i) any shares of common stock purchased by our "affiliates," as that term is defined in Rule 144 under the Securities Act and (ii) any shares purchased in our directed share program, which will be subject to the lock-up agreements described below. Shares purchased by our affiliates would be subject to the Rule 144 resale restrictions described below, other than the holding period requirement.

The remaining shares of common stock outstanding after this offering will be "restricted securities," as that term is defined in Rule 144 under the Securities Act. These restricted securities are eligible for public sale only if they are registered under the Securities Act or if they qualify for an exemption from registration under Rule 144 or Rule 701 under the Securities Act, each of which is summarized below. We expect that all of these shares will be subject to a 180-day lock-up period under the lock-up and market stand-off agreements described below.

We may issue shares of common stock from time to time as consideration for future acquisitions, investments, or other corporate purposes. In the event any such acquisition, investment, or other transaction is significant, the number of shares of common stock that we may issue may also be significant. We may also grant registration rights covering those shares of common stock issued in connection with any such acquisition, investment, or other transaction.

In addition, shares of common stock that are either subject to outstanding options or warrants or reserved for future issuance under our equity incentive plans will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules, the lock-up agreements described below, and Rules 144 and 701 under the Securities Act.

Lock-Up Agreements

We, along with our directors, executive officers, and substantially all of our other stockholders and optionholders, have agreed with the underwriters that for a period of 180 days, after the date of this prospectus, subject to specified exceptions as detailed further in "Underwriters" below, we or they will not, except with the prior written consent of the representatives, offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to sale of, or otherwise dispose of or transfer any shares of common stock or any securities convertible into or exercisable or exchangeable for shares of common stock, request or demand that we file a registration statement related to our common stock, or enter into any swap or other agreement that transfers to another, in whole or in part, directly or indirectly, the economic consequence of ownership of the common stock. All of our stockholders are subject to a market stand-off agreement with us which imposes similar restrictions.

Upon expiration of the lock-up period, certain of our stockholders will have the right to require us to register their shares under the Securities Act. See "—Registration Rights" below and the section titled "Description of Capital Stock—Registration Rights."

Upon the expiration of the lock-up period, substantially all of the shares subject to such lock-up restrictions will become eligible for sale, subject to the limitations discussed above.

Rule 144

In general, under Rule 144 as currently in effect, once we have been subject to public company reporting requirements of Section 13 or Section 15(d) of the Exchange Act for at least 90 days, an eligible stockholder is entitled to sell such shares without complying with the manner of sale, volume limitation, or notice provisions of Rule 144, subject to compliance with the public information requirements of Rule 144. To be an eligible stockholder under Rule 144, such stockholder must not be deemed to have been one of our affiliates for purposes of the Securities Act at any time during the 90 days preceding a sale and must have beneficially owned the shares proposed to be sold for at least six months, including the holding period of any prior owner other than our affiliates. If such a person has beneficially owned the shares proposed to be sold for at least one year, including the holding period of any prior owner other than our affiliates, then such person is entitled to sell such shares without complying with any of the requirements of Rule 144, subject to the expiration of the lock-up agreements described above.

In general, under Rule 144, as currently in effect, our affiliates or persons selling shares on behalf of our affiliates are entitled to sell shares on expiration of the lock-up agreements described above. Beginning 90 days after the date of this prospectus, within any three-month period, such stockholders may sell a number of shares that does not exceed the greater of:

- 1% of the number of shares of our common stock then outstanding, which will equal approximately 297,512 shares immediately after this offering; or
- the average weekly trading volume in our common stock on Nasdaq during the four calendar weeks preceding the filing of a notice on Form 144 with respect to such sale.

Sales under Rule 144 by our affiliates or persons selling shares on behalf of our affiliates are also subject to certain manner of sale provisions and notice requirements and to the availability of current public information about us.

Rule 701

Rule 701 generally allows a stockholder who was issued shares under a written compensatory plan or contract and who is not deemed to have been an affiliate of our company during the immediately preceding 90 days, to sell these shares in reliance on Rule 144, but without being required to comply with the public information, holding period, volume limitation, or notice provisions of Rule 144. Rule 701 also permits affiliates of our company to sell their Rule 701 shares under Rule 144 without complying with the holding period requirements of Rule 144. All holders of Rule 701 shares, however, are required by that rule to wait until 90 days after the date of this prospectus before selling those shares under Rule 701, subject to the expiration of the lock-up agreements described above.

Form S-8 Registration Statement

We intend to file one or more registration statements on Form S-8 under the Securities Act to register all shares of common stock subject to outstanding stock options and common stock issued or issuable under the 2011 Plan, the 2019 Plan, and the ESPP. We expect to file the registration statement covering shares offered pursuant to these stock plans shortly after the date of this prospectus, permitting the resale of such shares by non-affiliates in the public market without restriction under the Securities Act and the sale by affiliates in the public market subject to compliance with the resale provisions of Rule 144.

Registration Rights

As of March 31, 2019, holders of up to an aggregate of 18,790,983 shares of our common stock, which includes all of the shares of common stock issuable upon the automatic conversion of our redeemable convertible preferred stock immediately prior to the closing of this offering, or their transferees, and the shares issuable upon the exercise of warrants to purchase up to an aggregate of 316,241 shares of our common stock (on an as-converted basis), will be entitled to various rights with respect to the registration of these shares under the Securities Act upon the closing of this offering and the expiration of lock-up agreements. Registration of these shares under the Securities Act would result in these shares becoming fully tradable without restriction under the Securities Act immediately upon the effectiveness of the registration, except for shares purchased by affiliates. See the section titled “Description of Capital Stock—Registration Rights” for additional information. Shares covered by a registration statement will be eligible for sale in the public market upon the expiration or release from the terms of the lock-up agreement.

MATERIAL U.S. FEDERAL INCOME TAX CONSEQUENCES TO NON-U.S. HOLDERS OF OUR COMMON STOCK

The following summary describes the material U.S. federal income tax consequences of the acquisition, ownership, and disposition of our common stock acquired in this offering by Non-U.S. Holders (as defined below). This discussion is not a complete analysis of all potential U.S. federal income tax consequences relating thereto, and does not deal with foreign, state, and local consequences that may be relevant to Non-U.S. Holders in light of their particular circumstances, nor does it address U.S. federal tax consequences (such as gift and estate taxes) other than income taxes. Special rules different from those described below may apply to certain Non-U.S. Holders that are subject to special treatment under the Internal Revenue Code of 1986, as amended (the "Code"), such as financial institutions, insurance companies, tax-exempt organizations, broker-dealers and traders in securities, U.S. expatriates, "controlled foreign corporations," "passive foreign investment companies," corporations that accumulate earnings to avoid U.S. federal income tax, corporations organized outside of the United States, any state thereof or the District of Columbia that are nonetheless treated as U.S. taxpayers for U.S. federal income tax purposes, persons that hold our common stock as part of a "straddle," "hedge," "conversion transaction," "synthetic security" or integrated investment or other risk reduction strategy, persons who acquire our common stock through the exercise of an option or otherwise as compensation, persons subject to the alternative minimum tax or federal Medicare contribution tax on net investment income, persons subject to special tax accounting rules under Section 451(b) of the Code, "qualified foreign pension funds" as defined in Section 897(l)(2) of the Code and entities all of the interests of which are held by qualified foreign pension funds, partnerships and other pass-through entities or arrangements, and investors in such pass-through entities or arrangements. Such Non-U.S. Holders are urged to consult their own tax advisors to determine the U.S. federal, state, local, and other tax consequences that may be relevant to them. Furthermore, the discussion below is based upon the provisions of the Code, and Treasury Regulations, rulings, and judicial decisions thereunder as of the date hereof, and such authorities may be repealed, revoked, or modified, perhaps retroactively, so as to result in U.S. federal income tax consequences different from those discussed below. We have not requested a ruling from the U.S. Internal Revenue Service (the "IRS") with respect to the statements made and the conclusions reached in the following summary, and there can be no assurance that the IRS will agree with such statements and conclusions. This discussion assumes that the Non-U.S. Holder holds our common stock as a "capital asset" within the meaning of Section 1221 of the Code (generally, property held for investment).

This discussion is for informational purposes only and is not tax advice. Persons considering the purchase of our common stock pursuant to this offering should consult their own tax advisors concerning the U.S. federal income, estate, and other tax consequences of acquiring, owning, and disposing of our common stock in light of their particular situations as well as any consequences arising under the laws of any other taxing jurisdiction, including any state, local, or foreign tax consequences.

For the purposes of this discussion, a "Non-U.S. Holder" is, for U.S. federal income tax purposes, a beneficial owner of common stock that is neither a U.S. Holder, nor a partnership (or other entity treated as a partnership for U.S. federal income tax purposes regardless of its place of organization or formation). A "U.S. Holder" means a beneficial owner of our common stock that is for U.S. federal income tax purposes any of the following:

- an individual who is a citizen or resident of the United States;
- a corporation or other entity treated as a corporation for U.S. federal income tax purposes created or organized in or under the laws of the United States, any state thereof, or the District of Columbia;
- an estate the income of which is subject to U.S. federal income taxation regardless of its source; or
- a trust if it (1) is subject to the primary supervision of a court within the United States and one or more U.S. persons have the authority to control all substantial decisions of the trust or (2) has a valid election in effect under applicable U.S. Treasury Regulations to be treated as a U.S. person.

Distributions

Distributions, if any, made on our common stock to a Non-U.S. Holder to the extent made out of our current or accumulated earnings and profits (as determined under U.S. federal income tax principles) generally will constitute dividends for U.S. tax purposes and will be subject to withholding tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty, subject to the discussions below regarding effectively connected income, backup withholding, and foreign accounts. To obtain a reduced rate of withholding under a treaty, a Non-U.S. Holder generally will be required to provide us with a properly executed IRS Form W-8BEN (in the case of individuals) or IRS Form W-8BEN-E (in the case of entities), or other appropriate form, certifying the Non-U.S. Holder's entitlement to benefits under that treaty. This certification must be provided to us or our paying agent prior to the payment of dividends and must be updated periodically. In the case of a Non-U.S. Holder that is an entity, Treasury Regulations and the relevant tax treaty provide rules to determine whether, for purposes of determining the applicability of a tax treaty, dividends will be treated as paid to the entity or to those holding an interest in that entity. If a Non-U.S. Holder holds stock through a financial institution or other agent acting on the holder's behalf, the holder will be required to provide appropriate documentation to such agent. The holder's agent will then be required to provide certification to us or our paying agent, either directly or through other intermediaries. If you are eligible for a reduced rate of U.S. federal withholding tax under an income tax treaty and you do not timely file the required certification, you may be able to obtain a refund or credit of any excess amounts withheld by timely filing an appropriate claim for a refund with the IRS.

We generally are not required to withhold tax on dividends paid to a Non-U.S. Holder that are effectively connected with the Non-U.S. Holder's conduct of a trade or business within the United States (and, if required by an applicable income tax treaty, are attributable to a permanent establishment or fixed base that such holder maintains in the United States) if a properly executed IRS Form W-8ECI, stating that the dividends are so connected, is furnished to us (or, if stock is held through a financial institution or other agent, to such agent). In general, such effectively connected dividends will be subject to U.S. federal income tax, on a net income basis at the regular rates applicable to U.S. residents. A corporate Non-U.S. Holder receiving effectively connected dividends may also be subject to an additional "branch profits tax," which is imposed, under certain circumstances, at a rate of 30% (or such lower rate as may be specified by an applicable treaty) on the corporate Non-U.S. Holder's effectively connected earnings and profits, subject to certain adjustments. Non-U.S. Holders should consult their tax advisors regarding any applicable income tax treaties that may provide for different rules.

To the extent distributions on our common stock, if any, exceed our current and accumulated earnings and profits, they will first reduce the Non-U.S. Holder's adjusted basis in our common stock, but not below zero, and then will be treated as gain to the extent of any excess amount distributed, and taxed in the same manner as gain realized from a sale or other disposition of common stock as described in the next section.

Gain on Disposition of Our Common Stock

Subject to the discussions below regarding backup withholding and foreign accounts, a Non-U.S. Holder generally will not be subject to U.S. federal income tax with respect to gain realized on a sale or other disposition of our common stock unless (a) the gain is effectively connected with a trade or business of such holder in the United States (and, if required by an applicable income tax treaty, is attributable to a permanent establishment or fixed base that such holder maintains in the United States), (b) the Non-U.S. Holder is a nonresident alien individual and is present in the United States for 183 or more days in the taxable year of the disposition and certain other conditions are met, or (c) we are or have been a "United States real property holding corporation" within the meaning of Code Section 897(c)(2) at any time within the shorter of the five-year period preceding such disposition or such holder's holding period. In general, we would be a United States real property holding corporation if our interests in U.S. real estate comprise (by fair market value) at least half of our business assets. We believe that we have not been and we are not, and do not anticipate becoming, a United States real property holding corporation. Even if we are treated as a United States real property holding corporation, gain realized by a Non-U.S. Holder on a disposition of our common stock will not be subject to U.S. federal income

tax so long as (1) the Non-U.S. Holder owned, directly, indirectly and constructively, no more than 5% of our common stock at all times within the shorter of (i) the five-year period preceding the disposition or (ii) the holder's holding period and (2) our common stock is regularly traded on an established securities market. There can be no assurance that our common stock will continue to qualify as regularly traded on an established securities market. If any gain on your disposition is taxable because we are a United States real property holding corporation and your ownership of our common stock exceeds 5%, you will be taxed on such disposition generally in the manner as gain that is effectively connected with the conduct of a U.S. trade or business (subject to the provisions under an applicable income tax treaty), except that the branch profits tax generally will not apply.

If you are a Non-U.S. Holder described in (a) above, you will be required to pay tax on the net gain derived from the sale at regular U.S. federal income tax rates, and corporate Non-U.S. Holders described in (a) above may be subject to the additional branch profits tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty. Gain described in (b) above will be subject to U.S. federal income tax at a flat 30% rate or such lower rate as may be specified by an applicable income tax treaty, which gain may be offset by certain U.S.-source capital losses (even though you are not considered a resident of the United States), provided that the Non-U.S. Holder has timely filed U.S. federal income tax returns with respect to such losses.

Information Reporting Requirements and Backup Withholding

Generally, we must report information to the IRS with respect to any dividends we pay on our common stock (even if the payments are exempt from withholding), including the amount of any such dividends, the name and address of the recipient, and the amount, if any, of tax withheld. A similar report is sent to the holder to whom any such dividends are paid. Pursuant to tax treaties or certain other agreements, the IRS may make its reports available to tax authorities in the recipient's country of residence.

Dividends paid by us (or our paying agents) to a Non-U.S. Holder may also be subject to U.S. backup withholding. U.S. backup withholding generally will not apply to a Non-U.S. Holder who provides a properly executed IRS Form W-8BEN, IRS Form W-8BEN-E, or IRS Form W-ECI, or otherwise establishes an exemption. Notwithstanding the foregoing, backup withholding may apply if the payor has actual knowledge, or reason to know, that the holder is a U.S. person who is not an exempt recipient.

U.S. information reporting and backup withholding requirements generally will apply to the proceeds of a disposition of our common stock effected by or through a U.S. office of any broker, U.S. or foreign, except that information reporting and such requirements may be avoided if the holder provides a properly executed IRS Form W-8BEN or IRS Form W-8BEN-E or otherwise meets documentary evidence requirements for establishing non-U.S. person status or otherwise establishes an exemption. Generally, U.S. information reporting and backup withholding requirements will not apply to a payment of disposition proceeds to a Non-U.S. Holder where the transaction is effected outside the United States through a non-U.S. office of a non-U.S. broker. Information reporting and backup withholding requirements may, however, apply to a payment of disposition proceeds if the broker has actual knowledge, or reason to know, that the holder is, in fact, a U.S. person. For information reporting purposes, certain brokers with substantial U.S. ownership or operations will generally be treated in a manner similar to U.S. brokers.

Backup withholding is not an additional tax. Any amounts withheld under the backup withholding rules may be credited against the tax liability of persons subject to backup withholding, provided that the required information is timely furnished to the IRS.

Foreign Accounts

Sections 1471 through 1474 of the Code (commonly referred to as FATCA) impose a U.S. federal withholding tax of 30% on certain payments, including dividends paid on, and the gross proceeds of a disposition

of, our common stock paid to a foreign financial institution (as specifically defined by applicable rules) unless such institution enters into an agreement with the U.S. government to withhold on certain payments and to collect and provide to the U.S. tax authorities substantial information regarding U.S. account holders of such institution (which includes certain equity holders of such institution, as well as certain account holders that are foreign entities with U.S. owners). FATCA also generally imposes a federal withholding tax of 30% on certain payments, including dividends paid on, and the gross proceeds of a disposition of, our common stock to a non-financial foreign entity unless such entity provides the withholding agent with either a certification that it does not have any substantial direct or indirect U.S. owners or provides information regarding substantial direct and indirect U.S. owners of the entity. An intergovernmental agreement between the United States and an applicable foreign country may modify those requirements. The withholding tax described above will not apply if the foreign financial institution or non-financial foreign entity otherwise qualifies for an exemption from the rules.

The withholding provisions described above currently apply to payments of dividends, and, subject to the recently released proposed Treasury Regulations described below, will apply to payments of gross proceeds from a sale or other disposition of common stock on or after January 1, 2019.

The U.S. Treasury Department recently released proposed regulations which, if finalized in their present form, would eliminate the federal withholding tax of 30% applicable to the gross proceeds of a disposition of our common stock. In its preamble to such proposed regulations, the U.S. Treasury Department stated that taxpayers may generally rely on the proposed regulations until final regulations are issued. Holders are encouraged to consult with their own tax advisors regarding the possible implications of FATCA on their investment in our common stock.

EACH PROSPECTIVE INVESTOR SHOULD CONSULT ITS OWN TAX ADVISOR REGARDING THE TAX CONSEQUENCES OF PURCHASING, HOLDING, AND DISPOSING OF OUR COMMON STOCK, INCLUDING THE CONSEQUENCES OF ANY RECENT OR PROPOSED CHANGE IN APPLICABLE LAW.

UNDERWRITERS

Under the terms and subject to the conditions in an underwriting agreement dated the date of this prospectus, the underwriters named below, for whom Morgan Stanley & Co. LLC, BofA Securities, Inc., and Cowen and Company, LLC are acting as representatives, have severally agreed to purchase, and we have agreed to sell to them, severally, the number of shares indicated below:

Name	Number of Shares
Morgan Stanley & Co. LLC	3,168,600
BofA Securities, Inc.	3,168,600
Cowen and Company, LLC	1,188,225
Oppenheimer & Co. Inc.	396,075
Total:	7,921,500

The underwriters and the representatives are collectively referred to as the "underwriters" and the "representatives," respectively. The underwriters are offering the shares of common stock subject to their acceptance of the shares from us and subject to prior sale. The underwriting agreement provides that the obligations of the several underwriters to pay for and accept delivery of the shares of common stock offered by this prospectus are subject to the approval of certain legal matters by their counsel and to certain other conditions. The underwriters are obligated to take and pay for all of the shares of common stock offered by this prospectus if any such shares are taken. However, the underwriters are not required to take or pay for the shares covered by the underwriters' over-allotment option described below.

The underwriters initially propose to offer part of the shares of common stock directly to the public at the offering price listed on the cover page of this prospectus and part to certain dealers at a price that represents a concession not in excess of $0.714 a share under the public offering price. After the initial offering of the shares of common stock, the offering price and other selling terms may from time to time be varied by the representatives.

We have granted to the underwriters an option, exercisable for 30 days from the date of this prospectus, to purchase up to 1,188,225 additional shares of common stock at the public offering price listed on the cover page of this prospectus, less underwriting discounts and commissions. The underwriters may exercise this option solely for the purpose of covering over-allotments, if any, made in connection with the offering of the shares of common stock offered by this prospectus. To the extent the option is exercised, each underwriter will become obligated, subject to certain conditions, to purchase about the same percentage of the additional shares of common stock as the number listed next to the underwriter's name in the preceding table bears to the total number of shares of common stock listed next to the names of all underwriters in the preceding table.

The following table shows the per share and total public offering price, underwriting discounts and commissions, and proceeds before expenses to us. These amounts are shown assuming both no exercise and full exercise of the underwriters' option to purchase up to an additional 1,188,225 shares of common stock.

	Per Share	Total	
		No Exercise	Full Exercise
Public offering price	$17.00	$134,665,500	$154,865,325
Underwriting discounts and commissions to be paid by us:	$ 1.19	$ 9,426,585	$ 10,840,573
Proceeds, before expenses, to us	$15.81	$125,238,915	$144,024,752

The estimated offering expenses payable by us, exclusive of the underwriting discounts and commissions, are approximately $3.2 million. We have agreed to reimburse the underwriters for expenses up to $37,500 relating to clearance of this offering with the Financial Industry Regulatory Authority and compliance with state securities or "blue sky" laws.

The underwriters have informed us that they do not intend sales to discretionary accounts to exceed 5% of the total number of shares of common stock offered by them.

We have been approved to list our common stock on The Nasdaq Global Market under the trading symbol “PSNL.”

We and all directors, officers, and the holders of substantially all of our outstanding stock and stock options have agreed that, without the prior written consent of the representatives on behalf of the underwriters, we and they will not, during the period ending 180 days after the date of this prospectus (the “restricted period”):

- offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, lend, or otherwise transfer or dispose of, directly or indirectly, any shares of common stock or any securities convertible into or exercisable or exchangeable for shares of common stock;
- file any registration statement with the Securities and Exchange Commission relating to the offering of any shares of common stock or any securities convertible into or exercisable or exchangeable for common stock; or
- enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of the common stock.

whether any such transaction described above is to be settled by delivery of common stock or such other securities, in cash or otherwise. In addition, we and each such person agrees that, without the prior written consent of the representatives on behalf of the underwriters, we or such other person will not, during the restricted period, make any demand for, or exercise any right with respect to, the registration of any shares of common stock or any security convertible into or exercisable or exchangeable for common stock.

The restrictions described in the immediately preceding paragraph to do not apply to our directors, officers, or holders of our outstanding common stock or other securities in certain circumstances, including (i) transactions by any person other than us relating to shares of our common stock or other securities acquired in this offering or in open market transactions after the closing of this offering, provided that no filing under Section 16(a) of the Securities Exchange Act of 1934, as amended (the “Exchange Act”) would be required or voluntarily made in connection with subsequent sales of the common stock or other securities acquired in such open market transactions; (ii) transfers of our common stock as bona fide gifts, by will, to an immediate family member or to certain trusts provided that no filing under Section 16(a) of the Exchange Act would be required or voluntarily made; (iii) distributions of our common stock to another corporation, partnership, limited liability company, trust, or other business entity that is an affiliate, or to an entity controlled or managed by an affiliate provided that no filing under Section 16(a) of the Exchange Act would be required or voluntarily made; (iv) distributions of our common stock to the stockholders, partners, or members of such holders provided that no filing under Section 16(a) of the Exchange Act would be required or voluntarily made; (v) the exercise of options or other equity awards granted under a stock incentive plan or other equity award plan described in this prospectus, or the exercise of warrants outstanding described in this prospectus provided that no filing under Section 16(a) of the Exchange Act would be required or voluntarily made within 60 days after the date of the final prospectus; (vi) transfers of our common stock to us for the net exercise of options, settlement of warrants granted pursuant to our equity incentive plans, or to cover tax withholding for grants pursuant to our equity incentive plans, provided that no filing under Section 16(a) of the Exchange Act would be required or voluntarily made within 60 days after the date of the final prospectus; (vii) the establishment by such holders of trading plans under Rule 10b5-1 under the Exchange Act provided that such plan does not provide for the transfer of common stock during the restricted period; (viii) transfers of our common stock pursuant to a domestic order, divorce settlement, or other court order; (ix) transfers of our common stock to us pursuant to any right to repurchase or any right of first refusal we may have over such shares; (x) conversion of our outstanding redeemable convertible preferred stock into common stock in connection with the closing of this offering; and (xi) transfers of our common stock pursuant to a bona fide third-party tender offer, merger, consolidation, or other similar transaction

that is approved by our board of directors. These restrictions also do not apply to us in certain circumstances including in connection with the issuance of up to 5% of our shares of common stock outstanding immediately following the closing of this offering in acquisitions or other similar strategic transactions.

The representatives, in their sole discretion, may release the common stock and other securities subject to the lock-up agreements described above in whole or in part at any time.

In order to facilitate the offering of the common stock, the underwriters may engage in transactions that stabilize, maintain, or otherwise affect the price of the common stock. Specifically, the underwriters may sell more shares than they are obligated to purchase under the underwriting agreement, creating a short position. A short sale is covered if the short position is no greater than the number of shares available for purchase by the underwriters under the over-allotment option described above. The underwriters can close out a covered short sale by exercising the over-allotment option or purchasing shares in the open market. In determining the source of shares to close out a covered short sale, the underwriters will consider, among other things, the open market price of shares compared to the price available under the over-allotment option. The underwriters may also sell shares in excess of the over-allotment option, creating a naked short position. The underwriters must close out any naked short position by purchasing shares in the open market. A naked short position is more likely to be created if the underwriters are concerned that there may be downward pressure on the price of the common stock in the open market after pricing that could adversely affect investors who purchase in this offering. As an additional means of facilitating this offering, the underwriters may bid for, and purchase, shares of common stock in the open market to stabilize the price of the common stock. These activities may raise or maintain the market price of the common stock above independent market levels or prevent or retard a decline in the market price of the common stock. The underwriters are not required to engage in these activities and may end any of these activities at any time.

We and the underwriters have agreed to indemnify each other against certain liabilities, including liabilities under the Securities Act.

A prospectus in electronic format may be made available on websites maintained by one or more underwriters, or selling group members, if any, participating in this offering. The representatives may agree to allocate a number of shares of common stock to underwriters for sale to their online brokerage account holders. Internet distributions will be allocated by the representatives to underwriters that may make Internet distributions on the same basis as other allocations.

Other Relationships

The underwriters and their respective affiliates are full service financial institutions engaged in various activities, which may include securities trading, commercial and investment banking, financial advisory, investment management, investment research, principal investment, hedging, financing, and brokerage activities. Certain of the underwriters and their respective affiliates have, from time to time, performed, and may in the future perform, various financial advisory and investment banking services for us, for which they received or will receive customary fees and expenses.

In addition, in the ordinary course of their various business activities, the underwriters and their respective affiliates may make or hold a broad array of investments and actively trade debt and equity securities (or related derivative securities) and financial instruments (including bank loans) for their own account and for the accounts of their customers and may at any time hold long and short positions in such securities and instruments. Such investment and securities activities may involve our securities and instruments. The underwriters and their respective affiliates may also make investment recommendations or publish or express independent research views in respect of such securities or instruments and may at any time hold, or recommend to clients that they acquire, long or short positions in such securities and instruments.

Pricing of the Offering

Prior to this offering, there has been no public market for our common stock. The initial public offering price has been determined by negotiations between us and the representatives. Among the factors considered in determining the initial public offering price were our future prospects and those of our industry in general, our sales, earnings, and certain other financial and operating information in recent periods, and the price-earnings ratios, price-sales ratios, market prices of securities, and certain financial and operating information of companies engaged in activities similar to ours.

Directed Share Program

At our request, the underwriters have reserved up to 333,333 shares of common stock for sale at the initial public offering price through a directed share program to our non-employee directors. The sales will be made at our direction by Morgan Stanley & Co. LLC and its affiliates through a directed share program. The number of shares of our common stock available for sale to the general public in this offering will be reduced to the extent that such persons purchase such reserved shares. Any reserved shares not so purchased will be offered by the underwriters to the general public on the same terms as the other shares of common stock offered by this prospectus. Any of our non-employee directors that participate in this directed share program will be subject to lockup and market standoff restrictions with the underwriters and with us with respect to any shares purchased through the directed share program. We have agreed to indemnify the underwriters against certain liabilities and expenses, including liabilities under the Securities Act, in connection with the sales of the shares reserved for the directed share program.

Selling Restrictions

Notice to Prospective Investors in Canada

The shares of our common stock may be sold only to purchasers purchasing, or deemed to be purchasing, as principal that are accredited investors, as defined in National Instrument 45-106 Prospectus Exemptions or subsection 73.3(1) of the Securities Act (Ontario), and are permitted clients, as defined in National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. Any resale of the shares of our common stock must be made in accordance with an exemption from, or in a transaction not subject to, the prospectus requirements of applicable securities laws.

Securities legislation in certain provinces or territories of Canada may provide a purchaser with remedies for rescission or damages if this prospectus (including any amendment thereto) contains a misrepresentation, provided that the remedies for rescission or damages are exercised by the purchaser within the time limit prescribed by the securities legislation of the purchaser's province or territory. The purchaser should refer to any applicable provisions of the securities legislation of the purchaser's province or territory for particulars of these rights or consult with a legal advisor.

Pursuant to section 3A.3 (or, in the case of securities issued or guaranteed by the government of a non-Canadian jurisdiction, section 3A.4) of National Instrument 33-105 Underwriting Conflicts (NI 33-105), the underwriters are not required to comply with the disclosure requirements of NI 33-105 regarding underwriter conflicts of interest in connection with this offering.

Notice to Prospective Investors in the European Economic Area

In relation to each Member State of the European Economic Area which has implemented the Prospectus Directive (each, a "Relevant Member State") an offer to the public of any shares of our common stock may not be made in that Relevant Member State, except that an offer to the public in that Relevant Member State of any shares of our common stock may be made at any time under the following exemptions under the Prospectus Directive, if they have been implemented in that Relevant Member State:

(a) to any legal entity which is a qualified investor as defined in the Prospectus Directive;

(b) to fewer than 100 or, if the Relevant Member State has implemented the relevant provision of the 2010 PD Amending Directive, 150, natural or legal persons (other than qualified investors as defined in the Prospectus Directive), as permitted under the Prospectus Directive, subject to obtaining the prior consent of the representatives for any such offer; or

(c) in any other circumstances falling within Article 3(2) of the Prospectus Directive, provided that no such offer of shares of our common stock shall result in a requirement for the publication by us or any underwriter of a prospectus pursuant to Article 3 of the Prospectus Directive.

For the purposes of this provision, the expression an "offer to the public" in relation to any shares of our common stock in any Relevant Member State means the communication in any form and by any means of sufficient information on the terms of the offer and any shares of our common stock to be offered so as to enable an investor to decide to purchase any shares of our common stock, as the same may be varied in that Member State by any measure implementing the Prospectus Directive in that Member State, the expression "Prospectus Directive" means Directive 2003/71/EC (and amendments thereto, including the 2010 PD Amending Directive, to the extent implemented in the Relevant Member State), and includes any relevant implementing measure in the Relevant Member State, and the expression "2010 PD Amending Directive" means Directive 2010/73/EU.

Notice to Prospective Investors in the United Kingdom

Each underwriter has represented and agreed that:

(a) it has only communicated or caused to be communicated and will only communicate or cause to be communicated an invitation or inducement to engage in investment activity (within the meaning of Section 21 of the Financial Services and Markets Act 2000 ("FSMA") received by it in connection with the issue or sale of the shares of our common stock in circumstances in which Section 21(1) of the FSMA does not apply to us; and

(b) it has complied and will comply with all applicable provisions of the FSMA with respect to anything done by it in relation to the shares of our common stock in, from or otherwise involving the United Kingdom.

Notice to Prospective Investors in Switzerland

The shares may not be publicly offered in Switzerland and will not be listed on the SIX Swiss Exchange ("SIX") or on any other stock exchange or regulated trading facility in Switzerland. This document has been prepared without regard to the disclosure standards for issuance prospectuses under art. 652a or art. 1156 of the Swiss Code of Obligations or the disclosure standards for listing prospectuses under art. 27 ff. of the SIX Listing Rules or the listing rules of any other stock exchange or regulated trading facility in Switzerland. Neither this document nor any other offering or marketing material relating to the shares or the offering may be publicly distributed or otherwise made publicly available in Switzerland.

Neither this document nor any other offering or marketing material relating to the offering, Personalis, Inc., or the shares have been or will be filed with or approved by any Swiss regulatory authority. In particular, this document will not be filed with, and the offer of shares will not be supervised by, the Swiss Financial Market Supervisory Authority FINMA ("FINMA"), and the offer of shares has not been and will not be authorized under the Swiss Federal Act on Collective Investment Schemes ("CISA"). The investor protection afforded to acquirers of interests in collective investment schemes under the CISA does not extend to acquirers of shares.

Notice to Prospective Investors in the Dubai International Financial Centre

This prospectus relates to an Exempt Offer in accordance with the Offered Securities Rules of the Dubai Financial Services Authority ("DFSA"). This prospectus is intended for distribution only to persons of a type

specified in the Offered Securities Rules of the DFSA. It must not be delivered to, or relied on by, any other person. The DFSA has no responsibility for reviewing or verifying any documents in connection with Exempt Offers. The DFSA has not approved this prospectus nor taken steps to verify the information set forth herein and has no responsibility for the prospectus. The shares to which this prospectus relates may be illiquid and/or subject to restrictions on their resale. Prospective purchasers of the shares offered should conduct their own due diligence on the shares. If you do not understand the contents of this prospectus you should consult an authorized financial advisor.

Notice to Prospective Investors in Australia

No placement document, prospectus, product disclosure statement or other disclosure document has been lodged with the Australian Securities and Investments Commission ("ASIC"), in relation to the offering. This prospectus does not constitute a prospectus, product disclosure statement or other disclosure document under the Corporations Act 2001 (the "Corporations Act"), and does not purport to include the information required for a prospectus, product disclosure statement or other disclosure document under the Corporations Act.

Any offer in Australia of the shares may only be made to persons (the "Exempt Investors") who are "sophisticated investors" (within the meaning of section 708(8) of the Corporations Act), "professional investors" (within the meaning of section 708(11) of the Corporations Act) or otherwise pursuant to one or more exemptions contained in section 708 of the Corporations Act so that it is lawful to offer the shares without disclosure to investors under Chapter 6D of the Corporations Act.

The shares applied for by Exempt Investors in Australia must not be offered for sale in Australia in the period of 12 months after the date of allotment under the offering, except in circumstances where disclosure to investors under Chapter 6D of the Corporations Act would not be required pursuant to an exemption under section 708 of the Corporations Act or otherwise or where the offer is pursuant to a disclosure document which complies with Chapter 6D of the Corporations Act. Any person acquiring shares must observe such Australian on-sale restrictions.

This prospectus contains general information only and does not take account of the investment objectives, financial situation or particular needs of any particular person. It does not contain any securities recommendations or financial product advice. Before making an investment decision, investors need to consider whether the information in this prospectus is appropriate to their needs, objectives and circumstances, and, if necessary, seek expert advice on those matters.

Notice to Prospective Investors in Hong Kong

The shares have not been offered or sold and will not be offered or sold in Hong Kong, by means of any document, other than (a) to "professional investors" as defined in the Securities and Futures Ordinance (Cap. 571) of Hong Kong and any rules made under that Ordinance; or (b) in other circumstances which do not result in the document being a "prospectus" as defined in the Companies Ordinance (Cap. 32) of Hong Kong or which do not constitute an offer to the public within the meaning of that Ordinance. No advertisement, invitation, or document relating to the shares has been or may be issued or has been or may be in the possession of any person for the purposes of issue, whether in Hong Kong or elsewhere, which is directed at, or the contents of which are likely to be accessed or read by, the public of Hong Kong (except if permitted to do so under the securities laws of Hong Kong) other than with respect to shares which are or are intended to be disposed of only to persons outside Hong Kong or only to "professional investors" as defined in the Securities and Futures Ordinance and any rules made under that Ordinance.

Notice to Prospective Investors in Japan

The shares have not been and will not be registered under the Financial Instruments and Exchange Law of Japan (Law No. 25 of 1948, as amended) and, accordingly, will not be offered or sold, directly or indirectly, in

Japan, or for the benefit of any Japanese Person or to others for re-offering or resale, directly or indirectly, in Japan or to any Japanese Person, except in compliance with all applicable laws, regulations, and ministerial guidelines promulgated by relevant Japanese governmental or regulatory authorities in effect at the relevant time. For the purposes of this paragraph, "Japanese Person" shall mean any person resident in Japan, including any corporation or other entity organized under the laws of Japan.

Notice to Prospective Investors in Singapore

This prospectus has not been registered as a prospectus with the Monetary Authority of Singapore. Accordingly, the shares were not offered or sold or caused to be made the subject of an invitation for subscription or purchase and will not be offered or sold or caused to be made the subject of an invitation for subscription or purchase, and this prospectus or any other document or material in connection with the offer or sale, or invitation for subscription or purchase, of the shares, has not been circulated or distributed, nor will it be circulated or distributed, whether directly or indirectly, to any person in Singapore other than (i) to an institutional investor (as defined in Section 4A of the Securities and Futures Act (Chapter 289) of Singapore, as modified or amended from time to time (the "SFA")) pursuant to Section 274 of the SFA, (ii) to a relevant person (as defined in Section 275(2) of the SFA) pursuant to Section 275(1) of the SFA, or any person pursuant to Section 275(1A) of the SFA, and in accordance with the conditions specified in Section 275 of the SFA, or (iii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA.

Where the shares are subscribed or purchased under Section 275 of the SFA by a relevant person, which is:

(a) a corporation (which is not an accredited investor (as defined in Section 4A of the SFA)), the sole business of which is to hold investments and the entire share capital of which is owned by one or more individuals, each of whom is an accredited investor; or

(b) a trust (where the trustee is not an accredited investor), whose sole purpose is to hold investments and each beneficiary of the trust is an individual who is an accredited investor,

securities or securities-based derivatives contracts (each term as defined in Section 2(1) of the SFA) of that corporation or the beneficiaries' rights and interest (howsoever described) in that trust shall not be transferred within six months after that corporation or that trust has acquired the shares pursuant to an offer made under Section 275 of the SFA, except:

(a) to an institutional investor or to a relevant person, or to any person arising from an offer referred to in Section 275(1A) or Section 276(4)(i)(B) of the SFA;

(b) where no consideration is or will be given for the transfer;

(c) where the transfer is by operation of law; or

(d) as specified in Section 276(7) of the SFA.

LEGAL MATTERS

The validity of the shares of common stock being offered by this prospectus will be passed upon for us by Cooley LLP, Palo Alto, California. As of the date of this prospectus, GC&H Investments, LLC, an entity comprised of partners and associates of Cooley LLP, beneficially owns 21,170 shares of our preferred stock, which will be converted into 21,170 shares of our common stock upon completion of this offering. Davis Polk & Wardwell LLP, Menlo Park, California, has acted as counsel to the underwriters in connection with this offering.

EXPERTS

The consolidated financial statements as of December 31, 2018 and 2017, and for each of the two years in the period ended December 31, 2018, included in this prospectus have been audited by Deloitte & Touche LLP, an independent registered public accounting firm, as stated in their report appearing herein. Such consolidated financial statements have been so included in reliance upon the report of such firm given upon their authority as experts in accounting and auditing.

CHANGES IN INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

In November 2018, our Board of Directors dismissed Moss Adams LLP ("Moss Adams") as our independent registered public accounting firm and engaged Deloitte & Touche LLP. Moss Adams' report on our financial statements for 2016 did not contain an adverse opinion or disclaimer of opinion and was not qualified or modified as to uncertainty, audit scope, or accounting principles. There were (i) no disagreements with Moss Adams on any matter of accounting principles or practices, financial statement disclosure, or auditing scope or procedures, which disagreements, if not resolved to the satisfaction of Moss Adams, would have caused Moss Adams to make reference to the subject matter of the disagreements in connection with its reports and (ii) no reportable events of the type listed in paragraphs (A) through (D) of Item 304(a)(1)(v) of Regulation S-K issued by the SEC, in connection with the audit of our financial statements for 2016 and the subsequent period through the replacement of Moss Adams with Deloitte & Touche LLP.

Neither we nor anyone acting on our behalf consulted with Deloitte & Touche LLP at any time prior to their retention by us as our independent registered public accounting firm regarding any of the matters described in Item 304(a)(2)(i) or Item 304(a)(2)(ii) of Regulation S-K.

We have provided Moss Adams with a copy of the disclosures set forth under the heading "Changes in Independent Registered Public Accounting Firm" included in this prospectus and have requested that Moss Adams furnish a letter addressed to the SEC stating whether or not Moss Adams agrees with statements related to them made by us under the heading "Changes in Independent Registered Public Accounting Firm" in this prospectus. A copy of that letter is filed as Exhibit 16.1 to the registration statement of which this prospectus forms a part.

WHERE YOU CAN FIND MORE INFORMATION

We have filed with the SEC a registration statement on Form S-1, including exhibits and schedules, under the Securities Act, with respect to the shares of common stock being offered by this prospectus. This prospectus, which constitutes part of the registration statement, does not contain all of the information in the registration statement and its exhibits. For further information with respect to us and the common stock offered by this prospectus, we refer you to the registration statement and its exhibits. Statements contained in this prospectus as to the contents of any contract or any other document referred to are not necessarily complete, and in each instance, we refer you to the copy of the contract or other document filed as an exhibit to the registration statement. Each of these statements is qualified in all respects by this reference.

You can read our SEC filings, including the registration statement, over the Internet at the SEC's website at www.sec.gov.

Upon the closing of this offering, we will be subject to the information reporting requirements of the Securities Exchange Act of 1934 and we will file reports, proxy statements, and other information with the SEC. These reports, proxy statements and other information will be available for inspection at the web site of the SEC referred to above. We also maintain a website at https://www.personalis.com, at which, following the closing of this offering, you may access these materials free of charge as soon as reasonably practicable after they are electronically filed with, or furnished to, the SEC. Information contained on or accessible through our website is not a part of this prospectus, and the inclusion of our website address in this prospectus is an inactive textual reference only.

PERSONALIS, INC. AND SUBSIDIARY

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the stockholders and the Board of Directors of Personalis, Inc.

Opinion on the Consolidated Financial Statements

We have audited the accompanying consolidated balance sheets of Personalis, Inc. and subsidiary (the "Company") as of December 31, 2017 and 2018, and the related consolidated statements of operations, comprehensive loss, redeemable convertible preferred stock and stockholders' deficit, and cash flows, for each of the two years in the period ended December 31, 2018, and the related notes (collectively, the "financial statements"). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2017 and 2018, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2018, in conformity with accounting principles generally accepted in the United States of America.

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 Public Company Accounting Oversight Board (United States) (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 audits to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits, we are required to obtain an understanding of internal control over financial reporting, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion.

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.

/s/ DELOITTE & TOUCHE LLP
San Jose, California
March 27, 2019 (June 4, 2019 as to the effects of the reverse stock split described in the second paragraph in Note 2)

We have served as the Company's auditor since 2018.

PERSONALIS, INC. AND SUBSIDIARY
CONSOLIDATED BALANCE SHEETS
(in thousands, except share and per share data)

	As of December 31,		As of March 31, 2019	Pro Forma March 31, 2019
	2017	2018	(unaudited)	(unaudited)
Assets				
Current assets				
Cash and cash equivalents	$ 22,617	$ 19,744	$ 33,237	$ 33,245
Accounts receivable	1,937	4,457	3,110	3,110
Inventory and other deferred costs	1,364	3,432	2,884	2,884
Prepaid expenses and other current assets	808	1,926	3,692	3,692
Total current assets	26,726	29,559	42,923	42,931
Property and equipment, net	6,342	11,452	12,218	12,218
Operating lease right-of-use assets	—	—	1,537	1,537
Other long-term assets	495	659	969	969
Total assets	$ 33,563	$ 41,670	$ 57,647	$ 57,655
Liabilities, Redeemable Convertible Preferred Stock, and Stockholders' Deficit				
Current liabilities				
Accounts payable	$ 4,035	$ 6,565	$ 7,997	$ 7,997
Accrued and other current liabilities	2,757	3,392	5,959	5,959
Contract liabilities	24,690	42,897	44,315	44,315
Short-term debt	17,506	4,996	—	—
Total current liabilities	48,988	57,850	58,271	58,271
Redeemable convertible preferred stock warrant liability	292	683	817	—
Compound derivative instrument	671	—	—	—
Long-term debt	—	—	18,941	18,941
Other long-term liabilities	220	121	737	737
Total liabilities	50,171	58,654	78,766	77,949
Commitments and contingencies (see Note 11)				
Total redeemable convertible preferred stock:				
Series A redeemable convertible preferred stock, $0.0001 par value—31,250,00 shares authorized and 7,812,497 shares issued and outstanding (liquidation preference of $2.624) as of December 31, 2017, December 31, 2018, and March 31, 2019; no shares authorized, issued, or outstanding, pro forma	20,261	20,261	20,261	—
Series B redeemable convertible preferred stock, $0.0001 par value—19,288,150 shares authorized and 4,799,548 shares issued or outstanding (liquidation preference of $4.600) as of December 31, 2017, December 31, 2018, and March 31, 2019; no shares authorized, issued, or outstanding, pro forma	22,047	22,047	22,047	—
Series C redeemable convertible preferred stock, $0.0001 par value—18,000,000 shares authorized and 4,194,700 shares issued and outstanding (liquidation preference of $8.052) as of December 31, 2017; 24,700,000 shares authorized and 5,862,697 shares issued and outstanding (liquidation preference of $8.052) as of December 31, 2018 and March 31, 2019; no shares authorized, issued, or outstanding, pro forma	33,687	47,096	47,096	—
Stockholders' deficit				
Common stock, $0.0001 par value—96,000,000 shares authorized and 3,051,467 shares issued and outstanding as of December 31, 2017; 102,700,000 shares authorized and 3,085,307 shares issued and outstanding as of December 31, 2018; 105,700,000 shares authorized and 3,166,316 shares issued and outstanding as of March 31, 2019; 105,700,000 shares authorized and 21,829,701 shares issued and outstanding, pro forma	1	1	1	2
Additional paid-in capital	3,025	9,131	10,666	101,784
Accumulated other comprehensive loss	(10)	(15)	—	—
Accumulated deficit	(95,619)	(115,505)	(121,190)	(122,080)
Total stockholders' deficit	(92,603)	(106,388)	(110,523)	(20,294)
Total liabilities, redeemable convertible preferred stock, and stockholders' deficit	$ 33,563	$ 41,670	$ 57,647	$ 57,655

See accompanying notes to consolidated financial statements.

PERSONALIS, INC. AND SUBSIDIARY
CONSOLIDATED STATEMENTS OF OPERATIONS
(in thousands, except share and per share data)

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
Revenues	$ 9,393	$ 37,774	$ 4,164	$ 14,075
Costs and expenses				
Costs of revenues	11,736	25,969	4,065	10,091
Research and development	9,919	14,304	2,949	5,245
Selling, general, and administrative	9,901	11,271	2,313	4,170
Total costs and expenses	31,556	51,544	9,327	19,506
Loss from operations	(22,163)	(13,770)	(5,163)	(5,431)
Interest income	100	293	61	84
Interest expense	(1,303)	(1,894)	(622)	(184)
Loss on debt extinguishment	—	(4,658)	—	—
Other (expense) income, net	(227)	150	351	(152)
Loss before income taxes	(23,593)	(19,879)	(5,373)	(5,683)
Provision for income taxes	(5)	(7)	(2)	(2)
Net loss	$ (23,598)	$ (19,886)	$ (5,375)	$ (5,685)
Net loss per share, basic and diluted	(7.78)	(6.49)	(1.76)	(1.84)
Weighted-average shares outstanding, basic and diluted	3,031,636	3,063,157	3,051,581	3,091,342
Pro forma net loss per share, basic and diluted (unaudited)		$ (0.95)		$ (0.26)
Pro forma weighted-average shares outstanding, basic and diluted (unaudited)		20,483,543		21,754,727

See accompanying notes to consolidated financial statements.

PERSONALIS, INC. AND SUBSIDIARY
CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS
(in thousands)

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
Net loss	$(23,598)	$(19,886)	$(5,375)	$(5,685)
Other comprehensive income (loss)				
Foreign currency translation adjustment	7	(5)	3	15
Comprehensive loss	$(23,591)	$(19,891)	$(5,372)	$(5,670)

See accompanying notes to consolidated financial statements.

PERSONALIS, INC. AND SUBSIDIARY
CONSOLIDATED STATEMENTS OF REDEEMABLE CONVERTIBLE PREFERRED STOCK AND STOCKHOLDERS' DEFICIT
(in thousands, except share data)

	Series A Redeemable Convertible Preferred Stock		Series B Redeemable Convertible Preferred Stock		Series C Redeemable Convertible Preferred Stock		Total	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Deficit
	Shares	Amount	Shares	Amount	Shares	Amount	Amount	Shares	Amount				
Balances at December 31, 2016	7,812,497	$ 20,261	4,799,548	$ 22,047	4,194,700	$ 33,687	$ 75,995	3,020,842	$ 1	$ 2,196	$ (17)	$ (72,021)	$ (69,841)
Proceeds from exercise of stock options								30,625	—	76			76
Stock-based compensation expense										753			753
Translation adjustments											7		7
Net loss												(23,598)	(23,598)
Balances at December 31, 2017	7,812,497	20,261	4,799,548	22,047	4,194,700	33,687	75,995	3,051,467	$ 1	3,025	(10)	(95,619)	(92,603)
Convertible Notes conversion on September 20, 2018 (see Note 6), net of issuance cost					1,667,997	13,409	13,409						
Equity component credited to additional paid-in capital upon Convertible Notes modifications on May 31, 2018 and August 20, 2018 (see Note 6)										4,690			4,690
Proceeds from exercise of stock options								33,840	—	99			99
Stock-based compensation expense										1,317			1,317
Translation adjustments											(5)		(5)
Net loss												(19,886)	(19,886)
Balances at December 31, 2018	7,812,497	$ 20,261	4,799,548	$ 22,047	5,862,697	$ 47,096	$ 89,404	3,085,307	$ 1	$ 9,131	$ (15)	$ (115,505)	$ (106,388)

See accompanying notes to consolidated financial statements.

PERSONALIS, INC. AND SUBSIDIARY
CONSOLIDATED STATEMENTS OF REDEEMABLE CONVERTIBLE PREFERRED STOCK AND STOCKHOLDERS' DEFICIT
(in thousands, except share data)

	Series A Redeemable Convertible Preferred Stock		Series B Redeemable Convertible Preferred Stock		Series C Redeemable Convertible Preferred Stock		Total	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Deficit
	Shares	Amount	Shares	Amount	Shares	Amount	Amount	Shares	Amount				
Balances at December 31, 2017	7,812,497	$20,261	4,799,548	$22,047	4,194,700	$33,687	$75,995	3,051,467	$ 1	$ 3,025	$ (10)	$ (95,619)	$ (92,603)
Stock-based compensation expense										172			172
Proceeds from exercise of stock options								12,656	—	23			23
Translation adjustments											3		3
Net loss												(5,375)	(5,375)
Balances at March 31, 2018	7,812,497	$20,261	4,799,548	$22,047	4,194,700	$33,687	$75,995	3,064,123	$ 1	$ 3,220	$ (7)	$ (100,994)	$ (97,780)
Balances at December 31, 2018	7,812,497	$20,261	4,799,548	$22,047	5,862,697	$47,096	$89,404	3,085,307	$ 1	$ 9,131	$ (15)	$ (115,505)	$ (106,388)
Stock-based compensation expense										609			609
Proceeds from exercise of stock options								81,009	—	354			354
Issuance of common stock warrants (Note 8)										572			572
Translation adjustments											15		15
Net loss												(5,685)	(5,685)
Balances at March 31, 2019	7,812,497	$20,261	4,799,548	$22,047	5,862,697	$47,096	$89,404	3,166,316	$ 1	$ 10,666	$ (0)	$ (121,190)	$ (110,523)

PERSONALIS, INC. AND SUBSIDIARY
CONSOLIDATED STATEMENTS OF CASH FLOWS
(in thousands)

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
Cash flows from operating activities:				
Net loss	$ (23,598)	$ (19,886)	$ (5,375)	$ (5,685)
Adjustments to reconcile net loss to net cash provided by operating activities				
Depreciation and amortization	1,216	3,066	471	1,047
Noncash lease expense	—	—	—	214
Stock-based compensation expense	753	1,317	169	609
Loss on debt extinguishment	—	4,658	—	—
Change in fair value of convertible preferred stock warrant liability	64	391	—	134
Change in fair value of compound derivative instrument	162	(574)	(353)	—
Accretion of noncash interest and debt reduction	928	1,188	475	22
Other	6	(5)	5	13
Changes in operating assets and liabilities				
Accounts receivable	(1,203)	(2,519)	177	1,346
Inventories and other deferred costs	(539)	(2,068)	(967)	548
Prepaid expenses and other current assets	177	(1,265)	22	(108)
Accounts payable	2,635	2,164	(732)	(820)
Accrued and other current liabilities	684	997	529	1,587
Contract liabilities	19,072	18,207	6,322	1,419
Other long-term liabilities	(67)	(99)	(20)	(260)
Net cash provided by operating activities	290	5,572	723	66
Cash flows from investing activities:				
Purchase of property and equipment	(5,158)	(7,852)	(1,309)	(960)
Net cash used in investing activities	(5,158)	(7,852)	(1,309)	(960)
Cash flows from financing activities:				
Borrowings	17,225	—	—	20,000
Payments of costs related to initial public offering				(477)
Debt issuance cost	(63)	—	—	(490)
Repayments under borrowing arrangements	(823)	(645)	(212)	(5,000)
Series C redeemable convertible preferred stock issuance costs	0	(22)	—	—
Proceeds from exercise of stock options	65	76	23	353
Net cash provided by (used in) financing activities	16,404	(591)	(189)	14,386
Effect of exchange rates on cash and cash equivalents	4	(2)	2	1
Net increase (decrease) in cash and cash equivalents	11,540	(2,873)	(773)	13,493
Cash and cash equivalents, beginning of the period	11,077	22,617	22,617	19,744
Cash and cash equivalents, end of the period	$ 22,617	$ 19,744	$ 21,844	$ 33,237
Supplemental disclosures of cash flow information:				
Cash paid for interest	$ 321	$ 698	$ 145	$ 375
Income taxes paid	5	7	—	—
Supplemental disclosures of noncash investing and financing activities:				
Property and equipment costs incurred but not paid	521	323	930	854
Convertible Notes conversion on September 20, 2018 (see Note 6)	—	13,431	—	—
Recognition of operating lease right-of-use asset	—	—	—	1,750
Unpaid initial public offering costs	—	—	—	1,487

See accompanying notes to consolidated financial statements.

PERSONALIS, INC. AND SUBSIDIARY
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

Note 1. Company and Nature of Business

Description of Business

Personalis, Inc. (the "Company") was incorporated in Delaware on February 21, 2011, and began operations in September 2011. The Company formed a wholly owned subsidiary, Personalis (UK) Ltd., in August 2013.

The Company is a growing cancer genomics company transforming the development of next-generation therapies by providing more comprehensive molecular data about each patient's cancer and immune response. The Company designed its NeXT Platform to adapt to the complex and evolving understanding of cancer, providing its biopharmaceutical customers with information on all of the approximately 20,000 human genes, together with the immune system, in contrast to many cancer panels that cover roughly 50 to 500 genes.

Significant Risks and Uncertainties

Since inception, the Company has been engaged in developing its complete sequencing technology, raising capital, and recruiting personnel. The Company has incurred net operating losses and negative cash flows from operations every year. At December 31, 2017 and 2018, the Company had an accumulated deficit of $95.6 million and $115.5 million, respectively, and $121.2 million for the three months ended March 31, 2019 (unaudited). The Company believes that its existing sources of liquidity will satisfy its working capital and capital requirements for at least 12 months. Failure to generate sufficient revenues, achieve planned gross margins, or control operating costs will require the Company to raise additional capital through equity or debt financing. Such additional financing may not be available on acceptable terms, or at all, and could require the Company to modify, delay, or abandon some of its planned future expansion or expenditures or reduce some of its ongoing operating costs, which could harm its business, operating results, financial condition, and ability to achieve its intended business objectives.

Note 2. Summary of Significant Accounting Policies

Basis of Presentation

The accompanying consolidated financial statements have been prepared in accordance with accounting principles generally accepted in the United States of America ("GAAP") and include all adjustments necessary for the fair presentation of the Company's consolidated financial position, results of operations, and cash flows as of and for the years ended December 31, 2017 and 2018. The Company's consolidated financial statements include the accounts of the Company and its wholly owned subsidiary, Personalis (UK), Ltd. All intercompany balances and transactions have been eliminated in consolidation.

Reverse Stock Split

On June 4, 2019, the Company filed an amendment to the Company's amended and restated certificate of incorporation to effect a reverse split of shares of the Company's common stock and redeemable convertible preferred stock on a four-for-one basis (the "Reverse Stock Split"). The par value of the common stock and redeemable convertible preferred stock was not adjusted as a result of the Reverse Stock Split. All references to common stock, options to purchase common stock, share data, per share data, redeemable convertible preferred stock and related information contained in these consolidated financial statements have been retrospectively adjusted to reflect the effect of the Reverse Stock Split for all periods presented.

Unaudited Interim Financial Information

The accompanying consolidated balance sheet as of March 31, 2019, the consolidated statements of operations and of cash flows for the three months ended March 31, 2018 and 2019, and the consolidated

statement of redeemable convertible preferred stock and stockholders' deficit for the three months ended March 31, 2019 are unaudited. The unaudited interim consolidated financial statements have been prepared on the same basis as the audited annual consolidated financial statements and, in the opinion of management, reflect all adjustments, which include only normal recurring adjustments, necessary for the fair statement of the Company's financial position as of March 31, 2019 and the results of its operations and its cash flows for the three months ended March 31, 2018 and 2019. The financial data and other information disclosed in these notes related to the three months ended March 31, 2018 and 2019 are also unaudited. The results for the three months ended March 31, 2019 are not necessarily indicative of results to be expected for the year ending December 31, 2019, any other interim periods, or any future year or period.

Unaudited Pro Forma Information

The March 31, 2019 unaudited consolidated pro forma balance sheet has been prepared assuming the following capital transactions will occur in connection with the Company's offering: (i) the automatic conversion of all outstanding shares of redeemable convertible preferred stock into shares of common stock; (ii) the automatic conversion of two warrants to purchase an aggregate of 84,585 shares of our redeemable convertible preferred stock, outstanding as of March 31, 2019, into warrants to purchase an equivalent number of shares of our common stock, and the related reclassification of redeemable convertible preferred stock warrant liability to stockholders' equity, (iii) the exercise of a warrant to purchase 188,643 shares of common stock, and (iv) stock-based compensation expense of $0.9 million associated with outstanding stock options subject to a performance condition for which the service-based vesting condition was satisfied as of March 31, 2019 and which the Company will recognize in connection with this offering.

The unaudited pro forma stockholders' deficit does not assume any proceeds from the offering.

The unaudited pro forma basic and diluted net loss per share have been computed to give effect to the automatic conversion of the redeemable convertible preferred stock into shares of common stock and the exercise of a warrant to purchase 188,643 shares of common stock as of the beginning of the respective period or the date of issuance, if later.

Use of Estimates

The preparation of consolidated financial statements in conformity with GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, and disclosure of contingent assets and liabilities, at the date of the consolidated financial statements and the reported amounts of revenues and expense during the reporting period. The estimates include, but are not limited to, useful lives assigned to long-lived assets, the valuation of common and convertible redeemable preferred stock and related warrants and options, the valuation of the compound derivative instrument, the valuation of stock-based awards, and provisions for income taxes and contingencies. Actual results could differ from these estimates, and such differences could be material to the Company's consolidated financial position and results of operations.

Segments

The Company determined its reporting and operating segments in accordance with Financial Accounting Standards Board ("FASB") Accounting Standards Codification ("ASC") Topic 280, *Segment Reporting*. The Company identifies an operating segment as an entity component that has its own discrete financial information, which is available and regularly reviewed by the chief operating decision maker or decision-making group when making decisions regarding resource allocation and performance assessment. The Company operates and manages its business as one reportable operating segment, which is the business of advanced genomics. The Company's chief executive officer, who is the chief operating decision maker, reviews financial information on an aggregate basis for purposes of allocating resources and evaluating financial performance.

Fair Value Measurements

The Company's financial instruments consist of cash and cash equivalents, accounts receivable, accounts payable, accrued liabilities, redeemable convertible preferred stock and convertible note liability, compound derivative instrument, and short-term and long-term debt. The Company states accounts receivable, accounts payable, and accrued liabilities at their carrying value, which approximates fair value due to the short time to the expected receipt or payment. The carrying amount of the Company's short-term debt approximates its fair value as the effective interest rate approximates market rates currently available to the Company. The convertible preferred stock warrant liability and compound derivative instrument associated with the Company's convertible note discussed in Note 5 are carried at fair value based on unobservable market inputs.

Cash and Cash Equivalents

The Company considers all highly liquid investments with original maturities of three months or less at the time of purchase to be cash and cash equivalents. Cash and cash equivalents consist primarily of amounts invested in money market funds.

Accounts Receivable

Trade accounts receivable are recorded at the invoiced amount and are noninterest bearing. At each reporting period, management reviews all outstanding customer balances to determine if the facts and circumstances of each customer relationship indicate the need for a reserve. The Company did not have any bad debt expense or allowance for doubtful accounts at December 31, 2017 and 2018 and March 31, 2019 (unaudited).

Inventories and Other Deferred Costs

Inventories, consisting of supplies used in the Company's genomic analysis contracts, are valued at the lower of cost or market value; cost is determined using actual costs, on a first-in, first-out basis. Market value is determined as the lower of replacement cost or net realizable value.

Other deferred costs relate to work in process for costs incurred on genomic analysis contracts that have not been completed or recognized as revenues. Other deferred costs represent materials used in sequencing services, labor, and overhead allocations.

Property and Equipment

Property and equipment are recorded at cost, less accumulated depreciation, and are depreciated on a straight-line basis over the estimated useful lives of the related assets, which is generally three to five years for computer equipment, two years for software, three years for furniture and equipment, and five years for machinery and equipment. Leasehold improvements are depreciated over the shorter of the lease term or the estimated useful life of the related asset. Upon retirement or sale, the cost and related accumulated depreciation and amortization are removed from the consolidated balance sheet, and the resulting gain or loss is reflected in the consolidated statements of operations. Maintenance and repairs that are not considered improvements and do not extend the useful lives of the assets are charged to operations as incurred.

Construction-in-process assets consist primarily of computer equipment and machinery and equipment that have not yet been placed in service. These assets are stated at cost and are not depreciated. Once the assets are placed into service, assets are reclassified to the appropriate asset class based on their nature and depreciated in accordance with the useful lives above.

Internally used software, whether purchased or developed, is capitalized at cost and amortized on a straight-line basis over its estimated useful life. Costs associated with internally developed software are expensed until

the point at which the project has reached the development stage. Subsequent additions, modifications or upgrades to internal-use software are capitalized only to the extent that they provide additional functionality. Software maintenance and training costs are expensed in the period in which they are incurred. The capitalization of software requires judgment in determining when a project has reached the development stage and the period over which the Company expects to benefit from the use of that software.

Deferred Offering Costs

On March 27, 2019, the Company submitted an initial registration statement with the U.S. Securities and Exchange Commission. As of March 31, 2019 (unaudited), deferred offering costs related to the filing totaling $2.0 million were capitalized and are included in "Prepaid expenses and other current assets".

Redeemable Convertible Preferred Stock

The redeemable convertible preferred stock is recorded outside of permanent equity because while it is not mandatorily redeemable, in the event of certain events considered not solely within the Company's control, such as a merger, acquisition, and sale of all or substantially all of the Company's assets (each, a "deemed liquidation event"), the redeemable convertible preferred stock will become redeemable at the option of the holders of at least a majority of the then-outstanding such shares. The Company has not adjusted the carrying values of the redeemable convertible preferred stock to the liquidation preferences of such shares because it is uncertain whether or when a deemed liquidation event would occur that would obligate the Company to pay the liquidation preferences to holders of shares of redeemable convertible preferred stock. Subsequent adjustments to the carrying values of the liquidation preferences will be made only when it becomes probable that such a deemed liquidation event will occur.

Common Stock Warrant

The Company's common stock warrant is classified in equity as it meets all criteria for equity classification. The common stock warrant is recorded at fair value upon issuance as additional paid-in capital in the consolidated balance sheets. The common stock warrant is not remeasured after the issuance date.

Convertible Preferred Stock Warrants

The Company's convertible preferred stock warrants require liability classification and accounting as the underlying convertible preferred stock is considered contingently redeemable and may obligate the Company to transfer assets to the holders at a future date upon occurrence of a deemed liquidation event. The warrants are recorded at fair value upon issuance and are subject to remeasurement to fair value at each consolidated balance sheet date, with any changes in fair value recognized in the consolidated statements of operations. The Company will continue to adjust the warrant liability for changes in fair value until the earlier of the exercise or expiration of the convertible preferred stock warrants, occurrence of a deemed liquidation event, or conversion of convertible preferred stock into common stock.

Compound Derivative Instrument

The convertible notes issued in June 2017 (see Note 6) contain embedded features that provide the lenders with multiple settlement alternatives. Certain of these settlement features provide the lenders a right to a fixed number of the Company's shares upon conversion of the notes (the "conversion option"). Other settlement features provide the lenders the right or the obligation to receive cash or a variable number of shares upon the completion of a capital-raising transaction, change of control, or default of the Company (the "redemption features").

Certain conversion and redemption features of the convertible notes met the requirements for separate accounting and were accounted for as a single, compound derivative instrument. The compound derivative instrument was recorded at fair value at inception and was subject to remeasurement to fair value at each consolidated balance sheet date, with any changes in fair value recognized in the consolidated statements of operations (see Note 9).

Concentration of Credit Risk and Other Risks and Uncertainties

Financial instruments that subject the Company to concentration of credit risk consist of cash and cash equivalents. The Company's cash and cash equivalents are deposited with a high-quality financial institution. Deposits at this institution may, at times, exceed federally insured limits. Management believes that this financial institution is financially sound and, accordingly, that minimal credit risk exists. The Company has not experienced any losses on its deposits of cash and cash equivalents.

The Company purchases various reagents and sequencing materials from sole source suppliers. Any extended interruption in the supply of these materials could result in the Company's inability to secure sufficient materials to conduct business and meet customer demand.

The Company routinely assesses the creditworthiness of its customers. The Company has not experienced any material losses related to receivables from individual customers, or groups of customers. The Company does not require collateral. Due to these factors, no additional credit risk is believed by management to be probable in the Company's accounts receivable.

As of December 31, 2017 and 2018 and as of March 31, 2018 and 2019, customers representing greater than 10% of accounts receivable were as follows:

	As of December 31,		As of March 31,	
	2017	2018	2018	2019
			(unaudited)	
Pfizer Inc.	13%	33%	11%	47%
Customer A	*	17%	*	*
Merck & Co., Inc.	38%	10%	22%	*
Customer B	*	10%	*	*
Customer C	13%	*	*	20%
VA MVP	*	*	38%	*

* Less than 10% of accounts receivable.

For the years ended December 31, 2017 and 2018 and for the three months ended March 31, 2018, and 2019, customers representing equal to or greater than 10% of revenues were as follows:

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
VA MVP	*	49%	47%	59%
Merck & Co., Inc.	11%	12%	12%	*
Pfizer Inc.	*	10%	*	17%
Customer A	13%	*	*	*
Customer B	10%	*	*	*

* Less than 10% of revenues.

Revenue Recognition

The Company applies the revenue recognition guidance in accordance with FASB ASC Topic 606, *Revenue from Contracts with Customers*.

Revenue Recognition

The revenue guidance provides a five-step framework through which revenue is recognized when control of promised goods or services is transferred to a customer at an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. To determine revenue recognition for arrangements that the Company concludes are within the scope of the new revenue recognition standard, management performs the following five steps: (i) identifies the contract(s) with a customer; (ii) identifies the performance obligations in the contract(s); (iii) determines the transaction price, including whether there are any constraints on variable consideration; (iv) allocates the transaction price to the performance obligations; and (v) recognizes revenue when (or as) the Company satisfies a performance obligation. At contract inception, once a contract is determined to be within the scope of the new revenue standard, the Company assesses whether individual goods or services promised within each contract are distinct and, therefore, represent separate performance obligation.

The Company derives revenues from sequencing and data analysis services to support the development of personalized cancer vaccines and other next-generation cancer immunotherapies. The Company's contracts are in the form of a combination of signed agreements, statements of work, and/or purchase orders. Under ASC Topic 606, the Company accounts for a contract with a customer when there is approval and commitment from both parties, the rights of the parties are identified, payment terms are identified, the contract has commercial substance, and it is probable that the Company will collect substantially all of the consideration to which it will be entitled.

The sequencing and data analysis services are the only distinct services that meet the definition of a performance obligation and are accounted for as one performance obligation under ASC Topic 606. The Company recognizes revenue from such services at the point in time when control of the test results is transferred to the customer. The Company has elected to exclude all sales and value added taxes from the measurement of the transaction price. Sequencing and data analysis services are based on a fixed price per test.

Payment terms and conditions vary by contract and customer. The Company's standard payment terms are less than 90 days from the invoice date. In instances where the timing of the Company's revenue recognition differs from the timing of its invoicing, the Company does not assess whether a contract has a significant financing component if the expectation at contract inception is such that the period between payment by the customer and the transfer of the promised services to the customer will be one year or less. The Company assessed each of its revenue-generating arrangements in order to determine whether a significant financing component exists and concluded that a significant financing component does not exist in any of its arrangements. The primary purpose of the Company's invoicing terms is to provide customers with simplified and predictable ways of purchasing the Company's services and provides payment protection for the Company.

Practical Expedients and Exemptions

As a practical expedient, the Company recognizes the incremental costs of obtaining contracts, such as sales commissions, as an expense when incurred since the amortization period of the asset the Company otherwise would have recognized is one year or less. Sales commissions are recorded within selling, general, and administrative expenses in the consolidated statements of operations.

Costs of Revenues

The Company's costs of revenues primarily consist of production materials, personnel costs (e.g., salaries, bonuses, benefit, and stock-based compensation), cost of expensed equipment, consumables and laboratory supplies, information technology ("IT") and facility costs, and depreciation and service maintenance contracts on capitalized equipment.

Research and Development Expenses

The Company incurs research and development expenses for costs it incurs in research aimed at developing new product offerings, including lab and automation development costs. The expenses primarily consist of employee-related costs (including stock-based compensation), laboratory and automation supplies and equipment, and related depreciation and amortization expenses.

Stock-Based Compensation

For options granted to employees, non-employees, and directors, stock-based compensation is measured at grant date based on the fair value of the award. The Company determines the grant-date fair value of the options using the Black-Scholes option-pricing model and records forfeitures as they occur. The fair value of options granted to non-employees is amortized over the vesting period.

Fair Value of Common Stock

The fair value of the Company's common stock is determined by the board of directors with assistance from management and, in part, on input from an independent third-party valuation firm. The board of directors determines the fair value of common stock by considering a number of objective and subjective factors, including valuations of comparable companies, sales of redeemable convertible preferred stock, operating and financial performance, the lack of liquidity of the Company's common stock and the general and industry-specific economic outlook.

Foreign Currency Translation

The functional currency of the Company's foreign subsidiary is the British pounds sterling. In preparing its consolidated financial statements, the Company is required to translate the financial statements of this subsidiary from British pounds sterling to U.S. dollars. Accordingly, monetary assets and liabilities of the Company's subsidiary are remeasured using exchange rates in effect at the end of the period. Costs in the local currency are remeasured using average exchange rates for the period, except for costs related to those consolidated balance sheet items that are remeasured using historical exchange rates. Since the Company's functional currency is deemed to be the local currency, any gain or loss associated with the translation of its consolidated financial statements is included, as a component of stockholders' deficit, in accumulated other comprehensive income (loss).

Comprehensive Loss

Comprehensive loss includes all changes in equity (net assets) during the period from nonowner sources. The Company's comprehensive loss consists of its net loss and its cumulative translation adjustments.

Income Taxes

The Company uses the asset and liability method under ASC Topic 740, *Income Taxes*, in accounting for income taxes. Deferred tax assets and liabilities are recognized for the estimated future tax consequences attributable to differences between the consolidated financial statement carrying amounts of existing assets and liabilities and their respective tax bases. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. Deferred tax expenses or benefits are the result of changes in the deferred tax assets and liabilities. Valuation allowances are established when necessary to reduce deferred tax assets where it is more likely than not that the deferred tax assets will not be realized.

ASC Topic 740 clarifies the accounting for uncertainty in income taxes recognized in the financial statements. ASC Topic 740 provides that a tax benefit from an uncertain tax position may be recognized when it

is more likely than not that the position will be sustained upon audit, including resolutions of any related appeals or litigation processes, based on the technical merits of the position. ASC Topic 740 also provides guidance on measurement, derecognition, classification, interest and penalties, accounting in interim periods, disclosure, and transition.

The Company recognizes interest and penalties related to unrecognized tax benefits within the income tax expense line in the accompanying consolidated statements of operations. Accrued interest and penalties are included within the related liability line in the consolidated balance sheets.

Net Loss per Share Attributable to Common Stockholders

Basic net loss per common share is calculated by dividing the net loss attributable to common stockholders by the weighted-average number of shares of common stock outstanding during the period, without consideration of potentially dilutive securities. Diluted net loss per share is computed by dividing the net loss attributable to common stockholders by the weighted-average number of shares of common stock and potentially dilutive securities outstanding for the period. For purposes of the diluted net loss per share calculation, the redeemable convertible preferred stock, convertible preferred stock warrants, common stock warrants, common stock subject to repurchase, and stock options are considered to be potentially dilutive securities. Basic and diluted net loss attributable to common stockholders per share is presented in conformity with the two-class method required for participating securities as the redeemable convertible preferred stock is considered a participating security. The Company's participating securities do not have a contractual obligation to share in the Company's losses. As such, the net loss is attributed entirely to common stockholders. Because the Company has reported a net loss for the reporting periods presented, the diluted net loss per common share is the same as basic net loss per common share for those periods.

Recent Accounting Pronouncements

From time to time, new accounting pronouncements are issued by the FASB or other standard-setting bodies and adopted by the Company as of the specified effective date, unless otherwise discussed below. The Company will meet the definition of a public business entity and will adopt recently issued accounting pronouncements in accordance with the transition provisions and effective dates for public business entities. Below is a summary of the recently issued accounting pronouncements that will be relevant to the Company.

Recently Adopted Accounting Pronouncements

In May 2014, the FASB issued ASU No. 2014-09, *Revenue from Contracts with Customers (Topic 606)*. Subsequently, the FASB also issued ASU No. 2015-14, *Revenue from Contracts with Customers (Topic 606)*, which adjusted the effective date of ASU No. 2014-09; ASU No. 2016-08, *Revenue from Contracts with Customers (Topic 606): Principal versus Agent Considerations (Reporting Revenue Gross versus Net)*, which amends the principal-versus-agent implementation guidance and illustrations in ASU No. 2014-09; ASU No. 2016-10, *Revenue from Contracts with Customers (Topic 606): Identifying Performance Obligations and Licensing*, which clarifies identifying performance obligation and licensing implementation guidance and illustrations in ASU No. 2014-09; and ASU No. 2016-12, *Revenue from Contracts with Customers (Topic 606): Narrow-Scope Improvements and Practical Expedients*, which addresses implementation issues and is intended to reduce the cost and complexity of applying the new revenue standard in ASU No. 2014-09 (collectively, the "Revenue ASUs").

The Revenue ASUs provide an accounting standard for a single comprehensive model for use in accounting for revenue arising from contracts with customers and supersedes most current revenue recognition guidance. The accounting standard is effective for interim and annual periods beginning after December 15, 2017. The guidance permits two methods of adoption: retrospectively to each prior reporting period presented (the full retrospective method), or retrospectively with the cumulative effect of initially applying the guidance recognized

at the date of initial application (the modified retrospective method). The Company performed a detailed review of its revenue agreements and assessed the differences in accounting for such contracts under this guidance compared with previous revenue accounting standards. On January 1, 2017, the Company early adopted ASU No. 2014-09 using the full retrospective method. The adoption of this standard did not have a material impact on the Company's consolidated financial statements. Results for all periods presented are under ASC Topic 606.

In June 2018, the FASB issued ASU No. 2018-07, *Improvements to Nonemployee Share-Based Payment Accounting*. ASU No. 2018-07 simplifies the accounting for share-based payments to nonemployees by aligning it with the accounting for share-based payments to employees, with certain exceptions. For all entities, the amendments are effective for annual periods beginning after December 15, 2019, and interim periods within annual periods beginning after December 15, 2020. Early adoption is permitted for any entity in any interim or annual period for which consolidated financial statements have not been issued or made available for issuance, but not before an entity adopts ASC Topic 606. The Company early adopted this guidance on January 1, 2017, which did not result in a material impact on its consolidated financial statements and related disclosures.

In February 2016, the FASB issued ASU No. 2016-02, *Leases (Topic 842)*. In July 2018, the FASB issued ASU No. 2018-10, *Codification Improvements to Topic 842, Leases*, which provides clarification to ASU 2016-02. These ASUs (collectively, the "new lease standard") require an entity to recognize a lease liability and a right-of-use ("ROU") asset on the balance sheet for leases with lease terms of more than twelve months. Lessor accounting is largely unchanged, while lessees will no longer be provided with a source of off-balance sheet financing. This guidance is effective for fiscal years beginning after December 15, 2018, including interim periods within those fiscal years. In July 2018, the FASB issued ASU No. 2018-11, *Leases (Topic 842)—Targeted Improvements*, which allows entities to elect a modified retrospective transition method where entities may continue to apply the existing lease guidance during the comparative periods and apply the new lease requirements through a cumulative effect adjustment in the period of adoptions rather than in the earliest period presented.

On January 1, 2019, the Company adopted Accounting Standard Update ("ASU") No. 2016-02, Leases (Topic 842), and its associated amendments using the modified retrospective transition method by applying the new standard to all leases existing at the date of initial application and not restating comparative periods. There was no cumulative-effect adjustment recorded to retained earnings upon adoption. Under the standard, a lessee is required to recognize a lease liability and ROU asset for all leases. The new guidance also modified the classification criteria and requires additional disclosures to enable users of financial statements to understand the amount, timing, and uncertainty of cash flows arising from leases. Consistent with current guidance, a lessee's recognition, measurement, and presentation of expenses and cash flows arising from a lease continues to depend primarily on its classification. The Company elected the package of practical expedients permitted under the transition guidance, which allowed the Company to carryforward its historical lease classification, its assessment on whether a contract was or contains a lease, and its initial direct costs for any leases that existed prior to January 1, 2019. In addition, the Company elected the short-term lease exception as a practical expedient.

At the date of adoption (unaudited), the Company derecognized a deferred rent liability in the amount of $0.3 million, and recognized a ROU asset and respective lease liability in the amount of $1.7 million and $2.0 million, respectively. As of March 31, 2019 (unaudited), lease liabilities in the amount of $1.0 million and $0.7 million are included in "Accrued and other current liabilities" and "Other long-term liabilities," respectively.

New Accounting Pronouncements Not Yet Adopted

In July 2017, the FASB issued ASU No. 2017-11, *Earnings Per Share (Topic 260) Distinguishing Liabilities from Equity (Topic 480) Derivatives and Hedging (Topic 815) (Part I) Accounting for Certain Financial Instruments with Down Round Features, (Part II) Replacement of the Indefinite Deferral for Mandatorily Redeemable Financial Instruments of Certain Nonpublic Entities and Certain Mandatorily*

Redeemable Noncontrolling Interests with a Scope Exception. This ASU simplifies the accounting for certain financial instruments with down round features, a provision in an equity-linked financial instrument (or embedded feature) that provides a downward adjustment of the current exercise price based on the price of future equity offerings. Down round features are common in warrants, preferred shares, and convertible debt instruments issued by private companies and early stage public companies. This ASU requires companies to disregard the down round feature when assessing whether the instrument is indexed to its own stock for purposes of determining liability or equity classification. The provisions of this ASU related to down round feature are effective for public entities for fiscal years and interim periods within those fiscal years, beginning after December 15, 2018. Early adoption is permitted. The amendments in Part I should be applied (1) retrospectively to outstanding financial instruments with down round features by means of a cumulative-effect adjustment to the consolidated balance sheets as of the beginning of the first fiscal year and interim periods and (2) retrospectively to outstanding financial instruments with down round features for each prior reporting period presented. The Company is currently evaluating the impact the adoption of this standard will have on its consolidated financial statements and related disclosures.

Note 3. Revenues

The following table presents the Company's revenues disaggregated by customer type (in thousands):

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
VA MVP	$ 421	$18,601	$1,977	$ 8,343
All other customers	8,972	19,173	2,187	5,732
Total	$9,393	$37,774	$4,164	$14,075

Countries outside of the United States, based on the billing addresses of customers, represented less than 2% and 3% of the Company's revenues for the years ended December 31, 2017 and 2018, respectively, and less than 4% and 2% for the three months ended March 31, 2018 and 2019 (unaudited), respectively.

Contract Assets and Liabilities

The Company had no contract assets as of December 31, 2017 and 2018 and March 31, 2019 (unaudited), respectively.

The Company's contract liabilities consist of customer deposits in excess of revenues recognized and are presented as current liabilities in the consolidated balance sheets.

The balance of customer deposits associated with advances received from customers at January 1, 2017 was $5.6 million. The balance of contract liabilities was $24.7 million and $42.9 million at December 31, 2017 and 2018, respectively. Contract liabilities of $1.1 million and $16.0 million were recognized in revenues during the years ended December 31, 2017 and 2018, respectively.

The balance of contract liabilities was $44.3 million at March 31, 2019 (unaudited). Contract liabilities of $1.6 million and $7.8 million were recognized in revenues during the three months ended March 31, 2018 and 2019 (unaudited), respectively.

As of December 31, 2018, the remaining performance obligations under contracts for which revenues are expected to be recognized over a period of more than one year is $73 million. Management expects to recognize such revenues over a three-year period.

The Company does not disclose remaining performance obligations under its other contracts since contract terms are less than a year and are recognized over a term of less than 12 months.

Note 4. Consolidated Balance Sheets

Inventory and other deferred costs consist of the following (in thousands):

	Year Ended December 31,		Three Months Ended March 31, 2019 (unaudited)
	2017	2018	
Raw materials	$ 822	$2,134	$ 2,245
Other deferred costs	542	1,298	639
Total inventory and other deferred costs	$1,364	$3,432	$ 2,884

Property and equipment, net consists of the following (in thousands):

	Year Ended December 31,		Three Months Ended March 31, 2019 (unaudited)
	2017	2018	
Computer equipment	$ 2,138	$ 6,822	$ 7,093
Computer software	248	202	202
Furniture and fixtures	150	150	157
Machinery and equipment	6,129	7,951	9,508
Leasehold improvements	235	1,016	1,248
Capitalized software costs	—	182	252
Construction in process	710	333	9
	9,610	16,656	18,469
Less: accumulated depreciation and amortization	(3,268)	(5,204)	(6,251)
Property and equipment, net	$ 6,342	$11,452	$ 12,218

Depreciation and amortization expense for the years ended December 31, 2017 and 2018 was $1.2 million and $3.1 million, respectively. Depreciation and amortization expense for the three months ended March 31, 2018 and 2019 (unaudited) was $0.5 million and $1.0 million, respectively.

Accrued and other current liabilities consist of the following (in thousands):

	Year Ended December 31,		Three Months Ended March 31, 2019 (unaudited)
	2017	2018	
Accrued compensation	$1,913	$2,843	$ 3,646
Accrued liabilities	88	59	2,065
Deferred rent	67	99	—
Accrued interest	563	207	19
Deferred revenues	18	3	8
Accrued taxes	108	181	221
Total accrued and other current liabilities	$2,757	$3,392	$ 5,959

Note 5. Fair Value Measurements

Financial assets and liabilities are recorded at fair value. Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability (an exit price) in an orderly transaction between market participants at the reporting date. The authoritative guidance establishes a three-level valuation hierarchy that prioritizes the inputs to valuation techniques used to measure fair value based upon whether such inputs are

observable or unobservable. Observable inputs reflect market data obtained from independent sources, while unobservable inputs reflect market assumptions made by the reporting entity.

The three-level hierarchy for the inputs to valuation techniques is briefly summarized as follows:

Level 1—Unadjusted quoted prices in active markets that are accessible to the reporting entity at the measurement date for identical assets and liabilities.

Level 2—Inputs other than quoted prices in active markets for identical assets and liabilities that are observable either directly or indirectly for substantially the full term of the asset or liability. Level 2 inputs include the following:

- Quoted prices for similar assets and liabilities in active markets
- Quoted prices for identical or similar assets or liabilities in markets that are not active
- Observable inputs other than quoted prices that are used in the valuation of the asset or liabilities (e.g., interest rate and yield curve quotes at commonly quoted intervals)
- Inputs that are derived principally from or corroborated by observable market data by correlation or other means

Level 3—Unobservable inputs for the assets or liabilities (i.e., supported by little or no market activity). Level 3 inputs include management's own assumptions about the assumptions that market participants would use in pricing the asset or liability (including assumptions about risk).

This hierarchy requires the Company to use observable market data, when available, and to minimize the use of unobservable inputs when determining fair value.

The following table represents the fair value hierarchy for the Company's financial assets and financial liabilities measured at fair value on a recurring basis (in thousands):

	As of December 31, 2017			
	Level 1	Level 2	Level 3	Total
Assets				
Money market funds	$21,650	$ —	$ —	$ 21,650
Total assets measured at fair value	$21,650	$ —	$ —	$ 21,650
Liabilities				
Compound derivative liability	—	—	$ (671)	$ (671)
Convertible preferred stock warrants liability	$ —	$ —	292	292
Total liabilities measured at fair value	$ —	$ —	$ (379)	$ (379)

	As of December 31, 2018			
	Level 1	Level 2	Level 3	Total
Assets				
Money market funds	$18,142	$ —	$ —	$ 18,142
Total assets measured at fair value	$18,142	$ —	$ —	$ 18,142
Liabilities				
Convertible preferred stock warrants liability	$ —	$ —	$ 683	$ 683
Total liabilities measured at fair value	$ —	$ —	$ 683	$ 683

	As of March 31, 2019 (unaudited)			
	Level 1	Level 2	Level 3	Total
Assets				
Money market funds	$28,698	$ —	$ —	$28,698
Total assets measured at fair value	$28,698	$ —	$ —	$28,698
Liabilities				
Convertible preferred stock warrants liability	$ —	$ —	$ 817	$ 817
Total liabilities measured at fair value	$ —	$ —	$ 817	$ 817

The fair value of the compound derivative instrument has been estimated at the date of inception in June 2017 and at each subsequent consolidated balance sheet date using a hybrid method that combines probability-weighted and with-or-without methods using unobservable inputs, which are classified as Level 3 within the fair value hierarchy. The primary inputs for this approach included the probability of achieving various settlement scenarios that provide the lenders the right or the obligation to receive cash or a variable number of shares upon the completion of a capital transaction. The probability assumptions related to estimating various settlement scenarios as of December 31, 2017 and 2018, and the inception date ranged between 0.2% and 70%, and a discount rate of 35.1% was applied to estimated future cash flows.

After the initial measurement, changes in the fair value of this compound derivative were recorded in other income (expense), net. The net derivative liability was reported within accrued and other current liabilities in the Company's consolidated balance sheets.

The Black-Scholes option-pricing model was used to estimate the fair value of the convertible preferred stock warrants. Under this option-pricing model, convertible preferred stock warrants were valued by creating a series of call options with exercise prices based on the liquidation preferences and conversion terms of each equity class. The values of the redeemable convertible preferred stock and common stock are inferred by analyzing these options.

The fair value of each convertible preferred stock warrant was estimated on the date of grant using the Black-Scholes option-pricing model with the assumptions described below. For the periods indicated the Company has limited historical volatility information available, and the expected volatility was based on actual volatility for comparable public companies projected over the expected terms of the warrants. The Company did not apply a forfeiture rate to the warrants as there is not enough historical information available to estimate such a rate. The risk-free interest rate was based on the U.S. Treasury yield curve at the time of the grant over the expected term of the warrants.

	Year Ended December 31,		Three Months Ended March 31, 2019
	2017	2018	(unaudited)
Expected term (in years)	6.75 - 7.50	5.17 - 7.0	5.50 - 7.00
Volatility	56.07% - 69.87%	55.56% - 56.42%	56.89% - 57.24%
Risk-free interest rate	1.97% - 2.33%	2.58% - 3.01%	2.25% - 2.31%
Dividend yield	0%	0%	0%

The following table sets forth a summary of the changes in the fair value of the Company's Level 3 financial instruments (in thousands):

	Warrant Liability	Derivative Asset	Derivative Liability
Balance—December 31, 2016	$ 59	$ —	$ —
Issuance of convertible preferred stock warrants	169	—	—
Initial fair value of derivative liability	—	—	509
Change in fair value	64	—	162
Balance—December 31, 2017	292	—	671
Initial fair value of derivative asset	—	623	—
Change in fair value	391	(97)	(671)
Elimination as a result of debt extinguishment	—	(526)	—
Balance—December 31, 2018	683	—	—
Change in fair value	134	—	—
Balance—March 31, 2019 (unaudited)	$ 817	$ —	$ —

Note 6. Borrowings

Amounts outstanding under the Company's financing arrangements consisted of the following (in thousands):

	Year Ended December 31,		Three Months Ended March 31, 2019
	2017	2018	(unaudited)
Credit agreement			
Term Loan	$ 753	$ —	$ —
Revolving Loan	5,000	5,000	—
Convertible Promissory Note	12,225	—	—
Growth Capital Loan	—	—	20,000
Total principal payments due	17,978	5,000	20,000
Less reduction in carrying value	(472)	(4)	(1,059)
Total amounts outstanding	17,506	4,996	18,941
Less: Current portion	(17,506)	(4,996)	—
Long-Term portion	$ —	$ —	$ 18,941

The repayment schedule relating to the Company's long-term debt as of March 31, 2019 is as follows (in thousands):

	March 31, (unaudited)
2019 (remaining nine months)	$ —
2020	4,395
2021	6,463
2022	7,212
2023	1,930
Thereafter	—
Total	$ 20,000

Term Loan

In September 2014, the Company entered into a loan and security agreement with Silicon Valley Bank (the "Term Loan"), to borrow up to $3.0 million under an equipment loan that will be secured with the equipment financed. On October 3, 2014, the Company borrowed $2.4 million under this loan agreement. The Term Loan required 12 interest-only payments, followed by 36 equal monthly installments of principal, plus interest, which began on October 3, 2015.

In connection with the Term Loan, the Company issued to the bank a 10-year warrant to purchase 22,489 shares of the Company's Series B redeemable convertible preferred stock (see Note 9).

The estimated fair value of the warrants upon draw down, of $0.1 million was based on the Black-Scholes option-pricing model. The Company recorded the fair value of the warrant at issuance as a reduction in the debt-carrying value and as a warrant liability. The debt-carrying value reduction is being accreted using the effective interest method as additional interest expense over the contractual period of four years for the Term Loan.

On September 30, 2018, this Term Loan was repaid in full.

Revolving Loan

In June 2017, the Company entered into a $10.0 million revolving loan and security agreement (the "Revolving Loan"). Borrowings under the Revolving Loan bear an interest rate of prime, plus 6.75%. The Revolving Loan also has a 5.5% end of term loan payment on the highest outstanding principal amount. The Revolving Loan requires monthly interest-only payments until the maturity date. The Revolving Loan's original maturity date was December 31, 2018, and in December 2018 the maturity date was further extended until March 22, 2019 (see Note 16). Upon determining that the change in cash flows between the previous and current credit facility was not greater than 10%, the Company accounted for the transaction as a debt modification.

As of December 31, 2017 and 2018, the Company's outstanding principal under the Revolving Loan was $5.0 million and $5.0 million was available to borrow.

In connection with the Revolving Loan, the Company issued a warrant to purchase up to 62,096 shares of the Company's Series C redeemable convertible preferred stock (see Note 9).

The estimated fair value of the warrant upon draw down, of $0.1 million was based on the Black-Scholes option-pricing model. The Company recorded the fair value of the warrant at issuance as a reduction in the debt-carrying value and as a warrant liability. The debt-carrying value reduction is being accreted using the effective interest method as additional interest expense over the contractual period of 1.5 years for the Revolving Loan.

The Revolving Loan had an effective interest rate of 19.22% per year. The Revolving Loan interest expense for the years ended December 31, 2017 and 2018, was $0.4 million and $0.9 million, respectively.

The Company accrued $0.1 million and $0.2 million, as of December 31, 2017 and 2018, respectively, related to accretion of final payment due at maturity per agreement using the effective interest rate method.

On March 22, 2019, this Revolving Loan was repaid in full.

Growth Capital Loan (unaudited)

On March 22, 2019, the Company entered into a growth capital loan with TriplePoint Capital LLC to provide for a $20.0 million growth capital loan facility and as of March 31, 2019 had drawn down the full $20.0 million available under the facility. The Company used $5.3 million of the growth capital loan facility to

repay, in its entirety, all amounts outstanding under the Revolving Loan. Borrowings under the growth capital loan bear interest at a floating rate of prime rate plus 5.00% for borrowings up to $15.0 million and the prime rate plus 6.50% for borrowing greater than $15.0 million; provided, however, that in an event of default, as defined in the loan and security agreement, the interest rate applicable to borrowings under such agreement will be increased by 5.0%. Under the agreement, the Company is required to make monthly interest-only payments through April 1, 2020 and is required to make 36 equal monthly payments of principal, plus accrued interest, from April 1, 2020 through March 1, 2023, when all unpaid principal and interest becomes due and payable. The Company may voluntarily prepay all, but not part, of the outstanding principal at any time prior to the maturity date, subject to a prepayment fee of 1% of the outstanding balance, if prepaid in months one through 12 of the loan term. If prepaid after month 12 of the loan term of any growth capital loan, no additional prepayment premium shall be due. In addition to the final payment, the Company will pay an amount equal to 2.75% of each principal amount drawn under this growth capital loan facility. In connection with the growth capital loan facility, the Company issued a warrant to purchase 65,502 shares of common stock to the lender at an exercise price of $9.16 per share. The Company recorded the issuance-date fair value of the warrant of $0.6 million and fees paid to the lender of $0.3 million as a debt discount which is amortized over the term of the growth capital loan using the effective interest rate method.

Upon issuance, the growth capital loan had an effective interest rate of 15.23% per year.

Convertible Notes

On June 29, 2017, the Company entered into a convertible promissory note agreement with certain existing redeemable convertible preferred stockholders and third parties (the “Investors”) for the issuance of convertible promissory notes with a face value of $12.2 million (the “Convertible Notes”). Under the terms of the Convertible Notes agreement, the Convertible Notes bear interest of 8% per annum, with a maturity date of June 28, 2018. In the event that the Company issued and sold shares of its equity securities (the “Equity Securities”) to Investors on or before the maturity date in an equity financing with total proceeds to the Company of not less than $10 million (including the conversion of the Convertible Notes or other convertible securities issued for capital raising purposes) (a “Qualified Financing”), then the outstanding principal amount of the Convertible Notes and any unpaid accrued interest would have automatically converted in whole without any further action by the holder into such Equity Securities sold in the Qualified Financing at a conversion price equal to the price paid per share for Equity Securities by the Investors in the Qualified Financing multiplied by 0.8. If the Company consummated a change of control while the Convertible Notes remained outstanding, the Company would have repaid the holders in cash an amount equal to 150% of the outstanding principal amount of the Convertible Notes, plus any unpaid accrued interest on the original principal. The Convertible Notes had customary events of default.

Certain conversion and redemption features of the Convertible Notes met the requirements for separate accounting and were accounted for as a single, compound derivative instrument (see Note 10). The compound derivative instrument was recorded at fair value at inception and was subject to remeasurement to fair value at each consolidated balance sheet date, with any changes in fair value recognized in the consolidated statements of operations. The estimated fair value of the compound derivative instrument at issuance was recorded as a reduction in the carrying value of the Convertible Notes and as a single compound derivative liability. The Convertible Notes carrying value reduction was accreted using the effective interest method as interest expense over the Convertible Notes contractual period of one year. The Convertible Notes had an effective interest rate of 12.69% per year.

On May 31, 2018, the original maturity date for the Convertible Notes was extended to June 28, 2019 (previously June 28, 2018). The maturity date extension was deemed substantial and was accounted for as a debt extinguishment under ASC 470, *Debt*. In connection with the debt extinguishment on May 31, 2018, the fair value of the Convertible Notes was allocated between the carrying amount of the Convertible Notes and accrued interested of $13.1 million, a compound derivative asset of $0.6 million, and an equity component of

$3.9 million, which was credited to additional paid-in capital within the consolidated statements of redeemable convertible preferred stock and stockholders' deficit. A $3.3 million loss on debt extinguishment was also recorded in the accompanying consolidated statements of operations. The new carrying value of the Convertible Notes was accreted using the effective interest method as interest expense over the new contractual period of 1.1 years.

On August 20, 2018, the maturity date for the Convertible Notes was changed to September 20, 2018 (previously June 28, 2019). The term change was deemed substantial and was accounted for as a debt extinguishment under ASC 470. In connection with the debt extinguishment on August 20, 2018, the fair value of the Convertible Notes was allocated between the new carrying amount of the Convertible Notes and accrued interest of $13.4 million, and an equity component of $0.8 million, which resulted in an additional credit to additional paid-in capital. A $0.8 million loss on debt extinguishment was also recorded in the accompanying consolidated statements of operations. The new carrying value of Convertible Notes was accreted using the effective interest method as interest expense over the new contractual period of one month.

On September 20, 2018, upon the maturity of the Convertible Notes, the carrying amount, including accrued interest of $13.4 million was converted into 1,667,997 shares of the Company's Series C redeemable convertible preferred stock at a conversion price equal to $8.052 per share. No gain or loss was recorded on the conversion.

The interest expense on the Convertible Notes for the years ended December 31, 2017 and 2018, was $0.7 million and $0.9 million, respectively.

Note 7. Income Taxes

For financial reporting purposes, loss before provision for income taxes, includes the following components (in thousands):

	Year Ended December 31,	
	2017	2018
Domestic	$ (23,613)	$ (19,897)
Foreign	20	18
Loss before income taxes	$ (23,593)	$ (19,879)

Provision for Income Taxes

The provision for income taxes consists of the following (in thousands):

	Year Ended December 31,	
	2017	2018
Current:		
Federal	$ —	$ —
State	1	2
Foreign	4	5
Total current	5	7
Provision for income taxes	$ 5	$ 7

Income tax provision related to continuing operations differ from the amounts computed by applying the statutory income tax rate of 34% to pretax loss in 2017 and 21% in 2018 as follows (in thousands):

U.S. Federal provision	Year Ended December 31, 2017	2018
At statutory rate	$ (8,022)	$ (4,175)
State taxes	(1,674)	(589)
Valuation allowance	(2,109)	4,188
Foreign tax differential	(3)	2
Rate impact due to tax reform	11,934	—
Research and development credit	(547)	(564)
Debt extinguishment	—	871
Other	426	274
Total	$ 5	$ 7

Tax Law Changes

The U.S. Tax Cuts and Jobs Act (the "Tax Act") was enacted on December 22, 2017. The Tax Act reduced the U.S. federal corporate tax rate from 35% in 2017 to 21% in 2018, required companies to pay a onetime transition tax on earnings of certain foreign subsidiaries that were previously tax deferred, and created new taxes on certain foreign sourced earnings. For the year ended December 31, 2017, the Company remeasured its deferred tax assets and liabilities based on the change in the federal rate to 21%. At December 31, 2018, the Company had completed its accounting for the Tax Act, which, other than the decrease in its gross deferred tax assets, did not have a material impact on the Company's financial statements.

Deferred Tax Assets and Liabilities

Deferred income taxes reflect the net tax effects of loss and credit carryforwards 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 the Company's deferred tax assets for federal and state income taxes are as follows (in thousands):

	Year Ended December 31, 2017	2018
Deferred tax assets:		
Net operating loss carryforwards	$ 22,783	$ 22,441
Research and development credits	3,535	4,634
Deferred revenue	1,475	4,839
Fixed assets	(875)	(751)
Accruals and reserves	434	460
Stock-based compensation	167	297
Inventory	43	42
Other intangibles	518	458
Other	(140)	3
Total gross deferred tax assets	27,940	32,423
Less: Valuation allowance	(27,940)	(32,423)
Total deferred tax assets	$ —	$ —

Realization of our deferred tax assets is dependent upon future earning, if any, the timing and amount of which are uncertain. Because of our lack of U.S. earnings history, the net U.S. deferred tax assets have been fully

offset by a valuation allowance. The valuation allowance decreased by $1.8 million for the year ended December 31, 2017, and increased by $4.5 million for the year ended December 31, 2018.

Net Operating Loss and Tax Credit Carryforwards

As of December 31, 2018, the Company had net operating loss carryforwards for federal income tax purposes of approximately $87.0 million, portions of which will begin to expire in 2031. The Company had a total state net operating loss carryforward of approximately $48.6 million, which will begin to expire in 2031. Utilization of some of the federal and state net operating loss and credit carryforwards are subject to annual limitations due to the "change in ownership" provisions of the Internal Revenue Code of 1986, as amended, and similar state provisions. The annual limitations may result in the expiration of net operating losses and credits before utilization for federal and state income tax purposes, respectively. The federal and state net operating loss carryforwards begin expiring in 2032, if not utilized.

The Company has federal credits of approximately $2.8 million, which will begin to expire in 2031 and state research credits of approximately $3.0 million which have no expiration date. These tax credits are subject to the same limitations discussed above.

Unrecognized Tax Benefits

The Company has incurred net operating losses since inceptions and does not have any significant unrecognized tax benefits. The Company's policy is to include interest and penalties related to unrecognized tax benefits, if any, within the provision for taxes in the consolidated statements of operations. If the Company is eventually able to recognize its uncertain positions, its effective tax rate would be reduced. The Company currently has a full valuation allowance against its net deferred tax asset, which would impact the timing of the effective tax rate benefit should any of these uncertain tax positions be favorably settled in the future. Any adjustments to the Company's uncertain tax positions would result in an adjustment of its net operating loss or tax credit carryforwards rather than resulting in a cash outlay.

The Company files income tax returns in the U.S. federal and various state income tax returns. Because of net operating losses and research credit carryovers, substantially all of the Company's tax years remain open to examination.

The Company has the following activity relating to unrecognized tax benefits (in thousands):

	As of December 31,	
	2017	2018
Beginning balance	$ 708	$ 917
Gross increase—tax position in current period	209	275
Ending balance	$ 917	$ 1,192

Although it is reasonably possible that certain unrecognized tax benefits may increase or decrease within the next 12 months due to tax examination changes, settlement activities, expirations of statute of limitations, or the impact on recognition and measurement considerations related to the results of published tax cases or other similar activities, the Company does not anticipate any significant changes to unrecognized tax benefits over the next 12 months. During the years ended December 31, 2017 and 2018, no significant interest or penalties were required to be recognized relating to unrecognized tax benefits.

Note 8. Common Stock Warrants

In connection with the sale of Series A redeemable convertible preferred stock in August 2011, the Company issued a warrant to purchase 188,643 shares of common stock to an investor who purchased Series A

redeemable convertible preferred stock in August 2011 at an exercise price of $0.04 per share. The common stock warrant expires in August 2021 and remained outstanding as of December 31, 2018.

In connection with the growth capital loan agreement (unaudited, see Note 6), the Company issued a warrant to purchase 65,502 shares of common stock to the lender at an exercise price of $9.16 per share. The Company recorded the issuance-date fair value of the warrant of $0.6 million in equity as the warrant met all criteria for equity classification.

Note 9. Convertible Preferred Stock Warrants

In September 2014, in connection with the Term Loan (see Note 6), the Company issued a warrant to purchase 22,489 shares of its Series B redeemable convertible preferred stock at an exercise price of $4.60 per share. The Series B convertible preferred stock warrant expires in September 2024 and remained outstanding as of March 31, 2019 (unaudited).

As of December 31, 2018, the remaining term of the Series B convertible preferred stock warrant was 6.75 years. The estimated fair value of the Series B convertible preferred stock warrant on the date of issuance of $0.1 million was recorded as a debt reduction. As of the issuance date, the fair value of the Series B convertible preferred stock warrant was calculated using the Black-Scholes option-pricing model and was based on a contractual term of ten years, a risk-free interest rate of 2.52%, expected volatility of 66.53%, and 0% expected dividend yield.

As of March 31, 2019 (unaudited), the remaining term of the Series B convertible preferred stock warrant was 5.5 years.

In June 2017, as additional consideration for the Revolving Loan (see Note 6), the Company issued a warrant to purchase up to 62,096 shares of its Series C redeemable convertible preferred stock at an exercise price of $8.052, subject to certain adjustments, such as any stock splits, stock dividends, recapitalizations, reclassifications, combinations, or similar transactions.

The remaining term of the Series C convertible preferred stock warrant is the greater of (i) seven years from June 28, 2017, or (ii) five years from the effective date of the Company’s initial public offering.

The estimated fair value of the Series C convertible preferred stock warrant on the date of issuance of $0.1 million was recorded as a debt reduction. As of the issuance date, the fair value of the Series C convertible preferred stock warrant was calculated using the Black-Scholes option-pricing model and was based on a contractual term of seven years, a risk-free interest rate of 1.97%, expected volatility of 64.33%, and 0% expected dividend yield.

At initial recognition, the convertible preferred stock warrants were recorded at their estimated fair values and were subject to remeasurement at each consolidated balance sheet date, with changes in fair value recognized as a component of net income. As of December 31, 2017 and 2018 and March 31, 2019 (unaudited), the fair values of the convertible preferred stock warrants were calculated to be $0.3 million, $0.7 million, and $0.8 million, respectively.

Note 10. Compound Derivative Instrument

Certain conversion and redemption features embedded in the Convertible Notes (see Note 6) were bifurcated from the notes and accounted for as separate compound derivative instrument. The Company remeasured the value of the compound derivative instrument on a recurring basis, with the change in fair value reflected as other income (expense) in the consolidated statements of operations. The compound derivative instrument was recorded as a compound derivative liability at fair value, which was $0.5 million as of the issuance date and $0.7 million and $0 as of December 31, 2017 and 2018, respectively (see Note 5).

Upon modification of the Convertible Notes on August 20, 2018 (see Note 6), the compound derivative asset was eliminated.

Note 11. Commitments and Contingencies

Operating Lease Obligations

In February 2015, the Company entered into a noncancelable operating lease for approximately 31,280 square feet of office space, which expires on November 30, 2020.

The Company recognizes rent expense on a straight-line basis over the noncancelable lease term. The Company's rent expense was $1.1 million for the years ended December 31, 2017 and 2018.

The Company adopted ASC 842 as of January 1, 2019. In determining the present value of lease payments, the Company uses its incremental borrowing rate based on the information available at the lease commencement date if the rate implicit in the lease is not readily determinable. At the date of adoption of ASC 842, the Company determined the amounts of lease liability using a discount rate of 8%, which represents the Company's incremental borrowing rate. The Company determines its incremental borrowing rate for lease liability using its current borrowing rate, adjusted for various factors including level of collateralization and term. Lease cost for the three-month period ended March 31, 2019 (unaudited) was $0.2 million. Cash paid for operating lease liabilities, included in cash flow from operating activities in the Consolidated Statement of Cash Flows, was $0.3 million for the three-month period ended March 31, 2019 (unaudited). As of March 31, 2019 (unaudited), the remaining lease term for the lease is 1.7 years.

Future minimum lease payments at December 31, 2018 under this noncancelable operating lease were as follows (in thousands):

	Amount
2019	$1,091
2020	1,030
Total future minimum lease payments	$2,121

Future minimum lease payments at March 31, 2019 (unaudited) under the lease were as follows (in thousands):

	Amount
2019 (excluding the three months ended March 31, 2019)	$ 824
2020	1,030
Total future minimum lease payments	1,854
Less: imputed interest	(115)
Present value of future minimum lease payments	1,739
Less: current portion of operating lease liability	(1,001)
Operating lease liabilities - noncurrent	$ 738

Contingencies

The Company is subject to claims and assessments from time to time in the ordinary course of business. Accruals for litigation and contingencies are reflected in the consolidated financial statements based on management's assessment, including the advice of legal counsel, of the expected outcome of litigation or other dispute resolution proceedings and/or the expected resolution of contingencies. Liabilities for estimated losses

are accrued if the potential losses from any claims or legal proceedings are considered probable and the amounts can be reasonably estimated. Significant judgment is required in both the determination of probability of loss and the determination as to whether the amount can be reasonably estimated. Accruals are based only on information available at the time of the assessment due to the uncertain nature of such matters. As additional information becomes available, management reassesses potential liabilities related to pending claims and litigation and may revise its previous estimates, which could materially affect the Company's consolidated results of operations in a given period. As of December 31, 2017 and 2018 and March 31, 2019 (unaudited), the Company was not involved in any material legal proceedings.

Indemnification

In the normal course of business, the Company enters into contracts and agreements that contain a variety of representations and warranties and provide for general indemnifications. The Company's exposure under these agreements is unknown because it involves claims that may be made against the Company in the future, but that have not yet been made. To date, the Company has not paid any claims or been required to defend any action related to its indemnification obligations. However, the Company may record charges in the future as a result of these indemnification obligations.

Note 12. Redeemable Convertible Preferred Stock

The Company's certificate of incorporation, as amended, authorizes it to issue 75,238,150 shares of $0.0001 par value redeemable convertible preferred stock, with 31,250,000 shares of preferred stock designated as Series A redeemable convertible preferred stock, 19,288,150 shares of redeemable preferred stock designated as Series B redeemable convertible preferred stock, and 24,700,000 shares of preferred stock designated as Series C redeemable convertible preferred stock.

Redeemable convertible preferred stock at December 31, 2017, consisted of the following (in thousands, except share and per share data):

As of December 31, 2017

Series	Shares Authorized	Shares Outstanding	Liquidation Amount	Issuance Costs	Original Issuance Price
Series A redeemable convertible preferred stock	31,250,000	7,812,497	$ 20,500	$ 82	$ 2.624
Series B redeemable convertible preferred stock	19,288,150	4,799,548	22,078	31	4.600
Series C redeemable convertible preferred stock	18,000,000	4,194,700	33,776	89	8.052
	68,538,150	16,806,745	$ 76,354	$ 202	

Redeemable convertible preferred stock at December 31, 2018, consisted of the following (in thousands, except share and per share data):

As of December 31, 2018

Series	Shares Authorized	Shares Outstanding	Liquidation Amount	Issuance Costs	Original Issuance Price
Series A redeemable convertible preferred stock	31,250,000	7,812,497	$ 20,500	$ 82	$ 2.624
Series B redeemable convertible preferred stock	19,288,150	4,799,548	22,078	31	4.600
Series C redeemable convertible preferred stock	24,700,000	5,862,697	47,206	110	8.052
	75,238,150	18,474,742	$ 89,784	$ 223	

Redeemable convertible preferred stock at March 31, 2019, consisted of the following (in thousands, except share and per share data):

As of March 31, 2019 (unaudited)

Series	Shares Authorized	Shares Outstanding	Liquidation Amount	Issuance Costs	Issuance Price
Series A redeemable convertible preferred stock	31,250,000	7,812,497	$ 20,500	$ 82	$ 2.624
Series B redeemable convertible preferred stock	19,288,150	4,799,548	22,078	31	4.600
Series C redeemable convertible preferred stock	24,700,000	5,862,697	47,206	110	8.052
	75,238,150	18,474,742	$ 89,784	$ 223	

The rights and preferences of holders of the redeemable convertible preferred stock are as follows:

Dividends

Holders of the redeemable convertible preferred stock are entitled to receive, prior and in preference to any declaration or payments of any dividend on the common stock, noncumulative dividends out of any assets legally available at the per annum rate of 8% of the original issuance price of the redeemable convertible preferred stock, when and if declared by the board of directors.

No dividends shall be paid on any common stock until dividends to the holders of the redeemable convertible preferred stock have been paid. After payment of dividends to holders of the redeemable convertible preferred stock, any additional dividends, when, as, and if declared by the board of directors, shall be distributed among all holders of common stock and all holders of redeemable convertible preferred stock pro rata based on the number of shares of common stock held by each holder on an as-converted basis. As of December 31, 2018, no dividends have been declared or paid to the holders of redeemable convertible preferred stock.

Voting Rights

Each share of redeemable convertible preferred stock has voting rights equal to an equivalent number of shares of common stock into which it is convertible and votes together as one class with the common stock. As

long as 250,000 shares of redeemable convertible preferred stock remain outstanding, the Company must obtain approval from the holders of a majority of the then-outstanding redeemable convertible preferred stock in order to alter the certificate of incorporation; increase or decrease the authorized number of shares of common stock or redeemable convertible preferred stock; authorize or designate any new class or series of stock or any other securities convertible into equity securities of the Company ranking on parity with or senior to the redeemable convertible preferred stock in redemption, liquidation preference, voting or dividend rights, or any increase in the authorized or designated number of any such class or series; effect any liquidation, dissolution, winding-up, recapitalization, reorganization, or change in control of the Company; change the number of authorized directors of the Company; or declare or pay any dividends on the common stock.

Liquidation Rights

In the event of any liquidation, dissolution, or winding-up of the Company, either voluntary or involuntary, holders of the redeemable convertible preferred stock shall be entitled to receive, prior to and in preference to any distribution of any of the assets to the holders of the common stock of the Company, an amount per share equal to the sum of the original issue price of the redeemable convertible preferred stock and all declared and unpaid dividends on such shares of redeemable convertible preferred stock. If upon the occurrence of such an event, the assets and funds distributed among the holders of the redeemable convertible preferred stock are insufficient to permit the payment to such holders of the redeemable convertible preferred stock, then the entire assets and funds of the Company legally available for distribution shall be distributed ratably among the holders of the redeemable convertible preferred stock in proportion to the full amount such holders are otherwise entitled to have received pursuant to the entitlement as noted above.

After the payment in full to holders of the redeemable convertible preferred stock as noted above, the remaining assets, if any, shall be distributed ratably to the holders of the common stock.

Conversion rights

Each share of redeemable convertible preferred stock is convertible, at the option of the holder, at any time after the date of issuance of such share for such redeemable convertible preferred stock. Each share of redeemable convertible preferred stock shall be convertible into the number of shares of common stock determined by dividing the original issuance price by the conversion price. The initial conversion price for each share of redeemable convertible preferred stock is the original issuance price for such share of redeemable convertible preferred stock.

Each share of redeemable convertible preferred stock automatically converts into the number of shares of common stock into which such shares are convertible at the then-effective conversion ratio (i) at any time upon the affirmative election of the holders of a majority of the outstanding shares of the redeemable convertible preferred stock or (ii) upon closing of a public offering of common stock in which the gross cash proceeds to the Company are at least $30.0 million.

Note 13. Stockholders' Deficit

The Company's certificate of incorporation, as amended, authorizes it to issue 105,700,000 shares of $0.0001 par value common stock. Common stockholders are entitled to dividends, subject to redeemable convertible preferred stock dividends, when and if declared by the board of directors. There have been no dividends declared to date. The holder of each common share is entitled to one vote.

Note 14. Stock Option Plan

In 2011, the Company established its 2011 stock option plan (the "2011 Plan") that provides for the granting of stock options to employees and nonemployees of the Company. Under the 2011 Plan, the Company has the

ability to issue incentive stock options ("ISOs"), nonstatutory stock options, stock appreciation rights, restricted stock awards, and restricted stock unit awards. Options under the 2011 Plan may be granted for periods of up to 10 years. The ISOs will be granted at a price per share not less than the fair value at the date of grant. The exercise price of an ISO granted to a 10% stockholder shall not be less than 110% of the estimated fair value of the shares on the date of grant, as determined by the board of directors. Options granted to new hires generally vest over a four-year period, with 25% vesting at the end of one year and the remaining vesting monthly thereafter; options granted as merit awards generally vest monthly over a four-year period. At December 31, 2018 and March 31, 2019 (unaudited), there were 4,647,839 shares and 5,450,683 shares, respectively, of common stock available for issuance under the 2011 Plan.

Early Exercise of Stock Options

For stock option grants issued prior to December 31, 2015, the Company allowed employees to exercise options granted under the 2011 Plan prior to vesting. The unvested shares are subject to the Company's repurchase rights at the original purchase price. Initially, the proceeds were recorded as an accrued liability from the early exercise of stock options and reclassified to common stock as the Company's repurchase rights lapse. There were 2,213 and 262 unvested shares subject to the Company's repurchase rights as of December 31, 2017 and 2018, respectively. There were 1,577 unvested shares subject to the Company's repurchase rights as of March 31, 2019 (unaudited).

	Outstanding Options			
(in thousands, except share and per share data)	Number of Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Term (in years)	Aggregate Intrinsic Value
Balance—December 31, 2016	2,112,394	$ 1.76	6.41	$ 2,451
Options granted	898,510	2.44		
Options exercised	(30,625)	2.12		15
Options canceled	(95,752)	3.20		
Balance—December 31, 2017	2,884,527	1.92	6.61	5,860
Options authorized				
Options granted	1,386,464	5.68		
Options exercised	(34,426)	2.80		96
Options canceled	(126,435)	2.96		
Balance—December 31, 2018	4,110,130	3.16	6.94	24,716
Options authorized	—			
Options granted	361,500	9.16		
Options exercised	(81,009)	4.36		
Options canceled	(8,737)	3.44		
Balance—March 31, 2019 (unaudited)	4,381,884	3.60	6.94	$ 41,980
Options vested and expected to vest as of December 31, 2018	4,110,138	3.16	6.94	24,716
Options vested and exerciseable as of December 31, 2018	2,322,492	1.80	5.12	17,043
Options vested and expected to vest as of March 31, 2019 (unaudited)	4,381,884	3.60	6.94	41,980
Options vested and exercisable as of March 31, 2019 (unaudited)	2,374,031	1.84	5.00	26,923

The weighted-average grant date fair values of options granted in the years ended December 31, 2017 and 2018, were $2.44 and $5.68, respectively. There were no options granted in the three months ended March 31,

2018 (unaudited). The weighted-average grant date fair values of options granted in the three months ended March 31, 2019 (unaudited) was $7.76. The total fair values of options vested during the years ended December 31, 2017 and 2018, were $0.6 million and $0.8 million, respectively. The total fair values of options vested during March 31, 2018 and 2019 (unaudited) were $0.1 million and $0.4 million, respectively. As of March 31, 2019 (unaudited), the unrecognized stock-based compensation of unvested options was $9.3 million, which is expected to be recognized over a weighted-average period of 3.5 years.

The Company estimated the fair value of stock options using the Black-Scholes option-pricing model. The fair value of stock options is recognized on a straight-line basis over the requisite service periods of the awards. The fair value of stock options was estimated using the following weighted-average assumptions:

	Year Ended December 31,		Three Months Ended March 31,
	2017	2018	2019 (unaudited)
Expected term (in years)	5.97 - 6.95	5.98 - 6.35	6.87
Volatility	56.05 - 65.78%	56.20 - 65.91%	56.20%
Risk-free interest rate	1.88 - 2.10%	2.77 - 2.87%	2.49% - 2.52%
Dividend yield	0%	0%	0%

Expected Term

The expected term is calculated using the simplified method, which is available if there is insufficient historical data about exercise patterns and post-vesting employment termination behavior. The simplified method is based on the vesting period and the contractual term for each grant, or for each vesting tranche for awards with graded vesting. The midpoint of the vesting date and the maximum contractual expiration date is used as the expected term under this method. For awards with multiple vesting tranches, the times from grant until the midpoints for each of the tranches may be averaged to provide an overall expected term.

Expected Volatility

The Company used an average historical stock price volatility of a peer group of publicly traded companies to be representative of its expected future stock price volatility, as the Company did not have any trading history for its common stock. For purposes of identifying these peer companies, the Company considered the industry, stage of development, size, and financial leverage of potential comparable companies. For each grant, the Company measured historical volatility over a period equivalent to the expected term.

Risk-Free Interest Rate

The risk-free interest rate is based on the implied yield currently available on U.S. Treasury zero-coupon issues with remaining terms equivalent to the expected term of a stock award.

Expected Dividend Rate

The Company has not paid and does not anticipate paying, any dividends in the near future. Accordingly, the Company has estimated the dividend yield to be zero.

As of March 31, 2019 (unaudited), the Company had outstanding 67,417 stock options with performance vesting conditions granted to several of its employees. The awards are subject to two vesting criteria: (i) a time-based service criterion, and (ii) a performance criterion of an initial public offering. Until both conditions have been met, shares are not considered to be vested. As of March 31, 2019 (unaudited), the awards' underlying conditions were not considered probable of occurrence and, therefore, no compensation cost was recognized. If an initial public offering had occurred on March 31, 2019 (unaudited), the Company would have recognized $0.9 million of stock-based compensation expense for all such outstanding options.

The following is a summary of stock-based compensation expense by function (in thousands):

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
Costs of revenues	$ 74	$ 177	$ 24	$ 85
Research and development	225	429	64	164
Selling, general, and administrative	454	711	81	360
Total stock-based compensation expense	$753	$1,317	$ 169	$ 609

Note 15. Net Loss per Share Attributable to Common Stockholders

Basic net loss per share is computed by dividing the net loss by the weighted-average number of common shares outstanding for the period. Because the Company reported a net loss for 2017 and 2018 and the three months ended March 31, 2018 and 2019, the number of shares used to calculate diluted net loss per common share is the same as the number of shares used to calculate basic net loss per common share for those periods presented because the potentially dilutive shares would have been antidilutive if included in the calculation.

The following table sets forth the computation of basic and diluted net loss per share attributable to common stockholders (in thousands, except share and per share data):

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
Numerator:				
Net loss attributable to common stockholders	$ (23,598)	$ (19,886)	$ (5,375)	$ (5,685)
Denominator:				
Weighted-average shares outstanding	3,035,791	3,063,516	3,051,809	3,091,504
Less weighted-average shares subject to repurchase	(4,155)	(359)	(228)	(162)
Weighted-average shares outstanding used in computing net loss per share attributable to common stockholders—basic and diluted	3,031,636	3,063,157	3,051,581	3,091,342
Net loss per share attributable to common stockholders—basic and diluted	$ (7.78)	$ (6.49)	$ (1.76)	$ (1.84)

The following outstanding shares of potentially dilutive securities were excluded from the computation of diluted net loss per share attributable to common stockholders for the periods presented because including them would have been antidilutive:

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
			(unaudited)	
Redeemable convertible preferred stock	16,806,746	18,474,742	16,806,746	18,474,742
Conversion of Convertible Notes(1)	1,580,151	—	1,610,100	—
Common stock warrant	188,643	188,643	188,643	254,145
Series B preferred stock warrant	22,489	22,489	22,489	22,489
Series C preferred stock warrant	62,096	62,096	62,096	62,096
Options to purchase common stock	2,884,527	4,110,130	2,836,878	4,381,884
Unvested early exercised common stock options	2,213	262	520	1,016
Total	21,546,865	22,858,362	21,527,472	23,196,372

(1) Calculated as $12.2 million principal and $0.5 million accrued but unpaid interest as of December 31, 2017. Calculated as $12.2 million principal and $0.7 million accrued but unpaid interest as of March 31, 2018 (unaudited).

Unaudited Pro Forma Net Loss per Share

Unaudited pro forma basic and diluted net loss per share was computed to give effect to the automatic one-for-one conversion of all outstanding shares of redeemable convertible preferred stock into shares of common stock in connection with a qualified initial public offering, using the if-converted method as though the conversion had occurred as of the beginning of the period presented or the date of issuance.

Unaudited pro forma basic and diluted loss per share is computed as follows (in thousands, except share and per share data):

	Year Ended December 31, 2018	Three Months Ended March 31, 2019 (unaudited)
Numerator:		
Net loss attributable to common stockholder	$ (19,886)	$ (5,685)
Adjust: Change in fair value of convertible preferred stock warrants	391	134
Pro forma net loss	$ (19,495)	$ (5,551)
Denominator:		
Weighted-average shares outstanding used in computing net loss per share attributable to common stockholders—basic and diluted	3,063,157	3,091,342
Adjust: Conversion of redeemable convertible preferred stock	17,231,743	18,474,742
Adjust: Conversion of common stock warrants	188,643	188,643
Weighted-average shares outstanding used in computing pro forma net loss per share—basic and diluted	20,483,543	21,754,727
Pro forma net loss per share—basic and diluted (unaudited)	$ (0.95)	$ (0.26)

Note 16. Subsequent Events

The Company evaluated subsequent events through March 27, 2019, the date on which the consolidated financial statements were available for issuance.

For the three months ended March 31, 2019, subsequent events were evaluated through May 23, 2019, the date on which the unaudited interim consolidated financial statements were available for issuance.

Reverse Stock Split

On June 4, 2019, the Company filed an amendment to the Company's amended and restated certificate of incorporation to effect a reverse split of shares of the Company's common stock and redeemable convertible preferred stock on a four-for-one basis (the "Reverse Stock Split"). The par value of the common stock and redeemable convertible preferred stock was not adjusted as a result of the Reverse Stock Split. All references to common stock, options to purchase common stock, share data, per share data, redeemable convertible preferred stock and related information contained in these consolidated financial statements have been retrospectively adjusted to reflect the effect of the Reverse Stock Split for all periods presented.

Table of Contents