

## PROSPECTUS

3,360,000 Units



This is our initial public offering. We are offering up to 3,360,000 units (each unit consisting of one share of our common stock and one warrant to purchase one share of our common stock) pursuant to this prospectus. Each warrant to purchase common stock contained in a unit entitles the holder to purchase one share of our common stock at an initial exercise price of \$6.125 per share (100% of the offering price per unit), subject to adjustment. Each such warrant will become exercisable 30 days after the date of this prospectus or on such date the underwriters separate the units, whichever date is earlier, and will expire five years from the date of this prospectus. The initial public offering price of one unit is \$6.125.

Our units, common stock and warrants have been approved for listing on the Nasdaq Stock Market LLC under the symbols “BNGOU,” “BNGO” and “BNGOW,” respectively.

The warrants and shares of our common stock will trade together as units only during the first 30 days following the date of this prospectus, and thereafter the units will automatically separate and the common stock and warrants will trade separately, unless Roth Capital Partners, LLC, as the representative of the underwriters, determines that an earlier date is acceptable based upon, among other things, its assessment of the relative strengths of the securities markets and small capitalization companies in general, and the trading pattern of, and demand for, our securities in particular.

We are an “emerging growth company” as defined by the Jumpstart Our Business Startups Act of 2012, and as such, have elected to comply with reduced public company reporting requirements and may elect to comply with reduced public company reporting requirements in future filings.

**Investing in our securities involves risks. See “Risk Factors” beginning on page 14 of this prospectus for a discussion of the risks that you should consider in connection with an investment in our securities.**

	Per Unit	Total
Initial public offering price	\$ 6.1250	\$ 20,580,000
Underwriting discounts and commissions <sup>(1)</sup>	\$ 0.4288	\$ 1,440,600
Proceeds to Bionano Genomics, Inc. (before expenses)	\$ 5.6963	\$ 19,139,400

(1) See “Underwriting” beginning on page 146 for additional information regarding underwriting compensation.

We have granted the underwriters an option to buy up to an additional 504,000 units from us at the initial public offering price, less the underwriting discounts and commissions, to cover over-allotments, if any. The underwriters may exercise this option at any time during the 30-day period from the date of this prospectus.

Certain of our existing stockholders, including entities affiliated with them or with certain of our directors, have indicated an interest in purchasing an aggregate of approximately \$13.0 million in units in this offering at the initial public offering price per unit. However, because indications of interest are not binding agreements or commitments to purchase, the underwriters may determine to sell more, less or no units in this offering to any of these persons or entities, or any of these persons or entities may determine to purchase more, less or no units in this offering. The underwriters will receive the same underwriting discount on any units purchased by these persons or entities as they will on any other units sold to the public in this offering.

The underwriters expect to deliver the units against payment on or about August 23, 2018.

**Neither the Securities and Exchange Commission nor any other regulatory body has approved or disapproved of these securities or passed upon the accuracy or adequacy of this prospectus. Any representation to the contrary is a criminal offense.**

*Sole Book-Running Manager*

**Roth Capital Partners**

*Lead Manager*

**Maxim Group LLC**

*Co-Manager*

**LifeSci Capital LLC**

The date of this prospectus is August 21, 2018.

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Neither we nor any of the underwriters have authorized anyone to provide you with any information or to make any representations other than as contained in this prospectus or in any free writing prospectuses we have prepared. Neither we nor the underwriters take responsibility for, and provide no assurance about the reliability of, any information that others may give you. This prospectus is an offer to sell only the securities offered hereby, but only under circumstances and in jurisdictions where it is lawful to do so. 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 any sale of the securities. Our business, financial condition, results of operations and prospects may have changed since that date.

Unless otherwise indicated, all references in this prospectus to “Bionano,” the “company,” “we,” “our,” “us” or similar terms refer to Bionano Genomics, Inc. and its subsidiaries.

No action is being taken in any jurisdiction outside the U.S. to permit a public offering of our securities or possession or distribution of this prospectus in any such jurisdiction. Persons who come into possession of this prospectus in jurisdictions outside the U.S. are required to inform themselves about and to observe any restrictions about this offering and the distribution of this prospectus applicable to those jurisdictions.

**Through and including September 15, 2018 (the 25<sup>th</sup> 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.**

## PROSPECTUS SUMMARY

*This summary highlights information contained elsewhere in this prospectus. This summary does not contain all of the information you should consider before investing in our securities. You should read this entire prospectus carefully, including “Risk Factors,” “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” and our financial statements and the related notes included elsewhere in this prospectus, before making an investment decision.*

### BIONANO GENOMICS, INC.

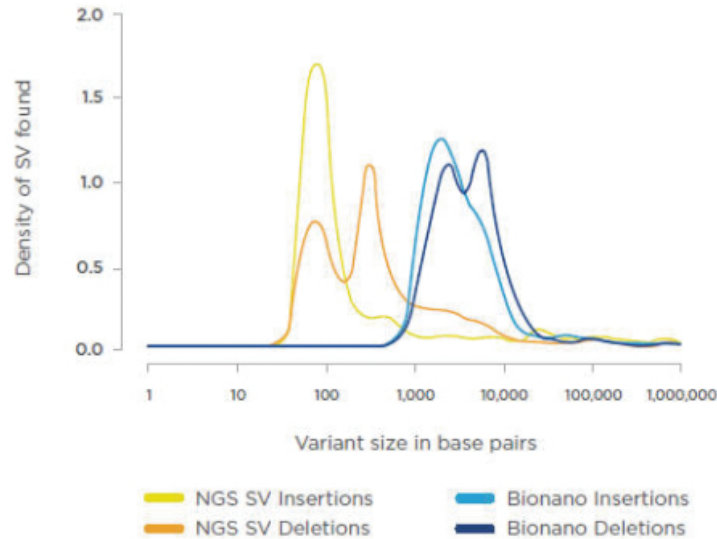
#### Overview

We are a life sciences instrumentation company in the genome analysis space. We develop and market the Saphyr system, a platform for ultra-sensitive and ultra-specific structural variation detection that enables researchers and clinicians to accelerate the search for new diagnostics and therapeutic targets and to streamline the study of changes in chromosomes, which is known as cytogenetics. Our Saphyr system comprises an instrument, chip consumables, reagents and a suite of data analysis tools.

Structural variation refers to large-scale structural differences in the genomic DNA of one individual compared to another. Each structural variation involves the rearrangement or repetition of as few as hundreds to as many as tens of millions of DNA base pairs. Structural variations may be inherited or arise spontaneously and many cause genetic disorders and diseases. Until our commercial launch of the Saphyr system in February 2017, and since, we believe no products existed or exist that could more comprehensively and cost and time-efficiently detect structural variation.

We have established relationships with key opinion leaders in genomics research and clinical applications, including rare diseases and oncology, and our installed base of over 90 systems made up of Saphyr and its predecessor includes some of the world’s most prominent clinical, translational research, basic research, academic and government institutions as well as leading pharmaceutical and diagnostic companies. Examples include Children’s National Health System, DuPont Pioneer, Garvan Institute of Medical Research, Genentech, Icahn School of Medicine at Mount Sinai, McDonnell Genome Institute at Washington University, National Institutes of Health, Pennsylvania State University and Salk Institute for Biological Studies. Our revenues in 2017 were \$9.5 million, representing approximately 40% growth over the prior year, and for the first half of 2018 our revenues were \$5.2 million, representing approximately 32% growth over the prior year comparable period. Our cumulative revenues for the period from January 1, 2016 through June 30, 2018 from each of the customers listed above were, respectively, \$0.5M, \$0.5M, \$0.3M, \$0.3M, \$0.1M, \$0.4M, \$0.1M, \$0.3M, and \$0.1M.

Approximately 6,000 research use only, or RUO, high throughput sequencers are currently installed worldwide. Sequencing is very good at detecting genome differences involving just a few base pairs or single-nucleotide variations, but sequencing, including next-generation sequencing, or NGS, cannot reliably detect the larger structural variations that our system can detect. Therefore, Saphyr is being adopted alongside this installed base of sequencers as a complement that gives users the ability to see a much wider scope of genome variation than ever before. As shown in the graphic below, the Garvan Institute of Medical Research generated data that we expect to be published which shows the density of structural variations found relative to the size of the structural variation found for our system (blue lines) against next-generation sequencing (Illumina; orange lines). Next-generation sequencing has a very significant deficiency in detecting structural variations. Given our system's ability to detect structural variations, it picks up essentially where next-generation sequencing drops off, as shown below.



The Saphyr system, which is for RUO, is also beginning to be adopted by cytogenetics labs that seek to use it in commercial clinical tests of its patients as a laboratory developed test, or LDT. These labs currently rely on existing methods such as karyotyping, fluorescence in situ hybridization, or FISH, and microarrays for clinical tests and research that look at chromosomal structure, location and function in cells. Major guidelines for oncology and genetic disease clinical diagnostics recommend first-line structural variation testing by these existing methods. The organizations issuing these guidelines include, among many others, World Health Organization (WHO), National Comprehensive Cancer Network (NCCN), American College of Medical Genetics (ACMG) and American College of Obstetricians & Gynecologists (ACOG).

We estimate that approximately 2,500 clinical cytogenetics labs exist worldwide. We believe Saphyr makes clinical testing for structural variations simpler, higher throughput, more cost effective and more scalable. In addition, we believe that Saphyr makes it easier for cytogenetics labs to accommodate new content when the research community validates newly discovered structural variation-based biomarkers for clinical diagnostics. Importantly, Saphyr can be used alone to provide comprehensive detection of structural variations and enable diagnostic calls without the need for any sequencing or cytogenetic technology.

Saphyr and its predecessor system, which we collectively refer to as our system in this prospectus, have been cited by researchers and clinicians in approximately 130 publications covering structural variations in areas of high unmet medical need and research interest, such as rare and undiagnosed pediatric diseases, muscular diseases, developmental delays and disorders, prostate cancer and leukemia.

### **Market Opportunity**

According to Research and Markets, the worldwide market for genomics products and services is expected to reach approximately \$23.9 billion by 2022, up from approximately \$14.7 billion in 2017, representing a compound annual growth rate of 10.2%.

We believe that the discovery research and cytogenetics segments together comprise an addressable opportunity for us to sell up to approximately 8,500 Saphyr systems, representing a current total instrument market opportunity of approximately \$2.1 billion. In addition to the instrument sales opportunity, Saphyr instruments generate recurring revenue from chip consumables that are used on a per-sample basis. We believe each Saphyr instrument has the potential to create recurring revenue in a range of approximately \$75,000 to approximately \$150,000 per year, suggesting a potential annual recurring revenue opportunity of approximately \$0.6 billion to approximately \$1.3 billion. Therefore, we believe that our currently addressable portion of the genome analysis market is estimated to be between \$2.7 billion and \$3.4 billion.

### **Existing Technologies and Their Limitations**

Even though both single nucleotide variation and structural variation are each very common, a much larger number of variant nucleotides in the average human genome are found in structural variations as compared to single nucleotide variations. A recent study showed that 30 million base pairs, on average, in the human genome are part of structural variations while only 10 million are single nucleotide variations. Sequencing and cytogenetics simply do not elucidate comprehensive structural variations in a systematic and cost- and time-efficient manner. Most structural variations found to date that have been implicated in disease were discovered through laborious, expensive, unindustrialized and non-comprehensive methods over the course of many years.

### ***The Limitations of Sequencing***

Nearly all genome sequencing, including next-generation sequencing, uses a method called sequencing by synthesis. Sequencing by synthesis is an in-vitro process for synthesizing a copy of DNA, one base at a time in a way that makes it possible to measure the identity of each base as it is incorporated into the growing DNA copy. The read lengths typical for next-generation sequencing are often too short to determine the right location and orientation of a reading frame in the genome because many of the reads from one chromosome are identical to reads from either another chromosome or even another location on the same chromosome. These short lengths disconnect and destroy most of the structural information of the original genome and make next-generation sequencing unable to reliably detect genomic variations larger than a few hundred base pairs.

The recognition of the need for greater lengths of sequence reads to determine genome structure, birthed the so-called long-read sequencing submarket. Because of the need for long-read sequencing, Pacific Biosciences of California developed a system that uses another alternative form of sequencing by synthesis, while Oxford Nanopore Technologies developed a system that uses nanopore technology. These systems provide users with average read lengths in the tens of thousands of base pairs. However, these read lengths have proven not to be long enough to reliably and comprehensively detect structural variations. Pacific Biosciences' polymerases cannot regularly produce reads that are the necessary hundreds of thousands of base pairs in length. In addition, Oxford Nanopore's system has difficulty reliably feeding molecules that are, on average, hundreds of thousands of base pairs in length through each nanopore. The time and cost of providing a comprehensive whole genome analysis of a patient in a clinical setting is prohibitive when using these longer-read technologies.

### ***The Limitations of Cytogenetics***

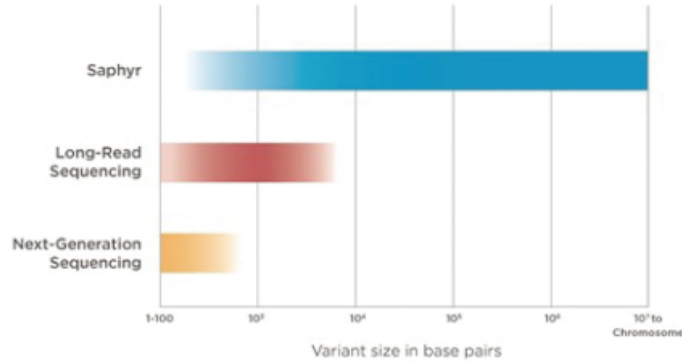
Cytogenetics is the study of chromosomal structure and how structural variations impact health. The field has historically relied on karyotyping, FISH and more recently, microarrays. These methods each can detect some structural variations, but they are all inadequate solutions for high volume and low cost genetic testing for structural variations, and none is an approach that can comprehensively detect structural variations with the ultra-high sensitivity and ultra-high specificity of the Saphyr system.

- Karyotyping is the gross optical examination of the chromosomes using a microscope. In this method, chromosomes are directly viewed on a slide by a pathologist with a microscope, resulting in resolution that is limited to structural events that are larger than five million base pairs. When karyotyping is used to diagnose unknown genetic disease, only about 5% of karyotyping tests result in a confirmed pathogenic finding. The test is costly, and its results are subject to each pathologist's interpretation which introduces variability in diagnostic calls and makes the methodology not amenable to automation.
- FISH is a molecular cytogenetic technique that is used to detect chromosomal aberrations. FISH is limited to known targets and cannot be used for discovery. Every FISH test performed needs to be chosen to look for a specific genetic marker that the clinician anticipates may be found based on the clinical symptoms of the patient. In addition, the test results can be ambiguous and inconclusive, and reproducibility and variability among users can be a significant issue. Like karyotyping, FISH's diagnostic yield is very low when used to diagnose unknown genetic disease with only an estimated 7% of FISH providing a confirmed pathogenic finding. In addition, FISH is expensive, especially for the limited amount of information that it provides.
- Chromosomal microarrays and SNP (single nucleotide polymorphism) arrays are tests consisting of slides that contain thousands of spots of DNA fragments that bind to the DNA of the sample. Microarrays have limited utility as a diagnostic tool as they are only useful when there are gains and losses of base pairs within the sample's genome that are specific to the probes that are populated on the array. Microarrays are also limited in their ability to provide specific locations of gains or losses on a chromosome, or even identify on which chromosome that the gains or losses occur. In addition, microarrays have low resolution as they cannot reliably detect structural variants smaller than 50,000 base pairs. Also, the diagnostic yield of microarrays is low. Only an estimated 20% of microarray tests provide a confirmed pathogenic finding when used to diagnose unknown genetic disease.

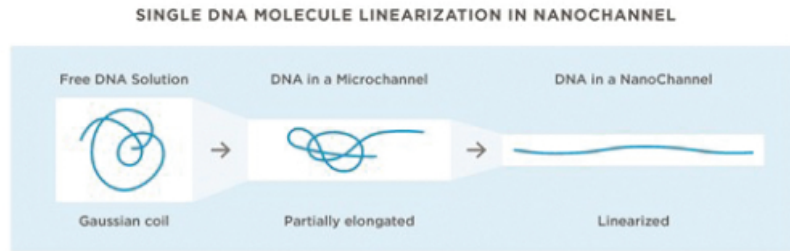
### Our Solution

Our approach to measuring genome structure and structural variation is novel and highly differentiated. Our Saphyr system directly observes extremely long genomic DNA without any amplification to construct a physical map that accurately assigns the chromosomal location, order, orientation and quantity of all the genome's functional elements. Our solution is built upon four key elements:

- **Extremely long molecules for analysis.** The Saphyr system is capable of analyzing single molecules that are on average approximately 250,000 base pairs long. These lengths are over 1,000 times longer than the average read length with Illumina systems and approximately 10 times longer than the average read lengths with Pacific Biosciences and Oxford Nanopore systems. Building a picture of the genome with massive building blocks overcomes the inherent challenge of genome complexity and is the key to Saphyr's unprecedented sensitivity and specificity.



- **Proprietary nanotechnology for massively parallel linearization and analysis of long molecules with single molecule imaging.** Analyzing these extremely long chromosomal fragments required invention. Molecules of this size are more like balls of yarn in a test tube and must be unraveled for meaningful analysis. We invented, patented, developed and commercialized nanochannel arrays to capture them from solution and unwind and linearize them for structural variation analysis. Each molecule is imaged separately, making it possible to deconvolute complex mixtures including haplotypes and heterogeneous tumors, as shown in the graphic below.



- **DNA labeling chemistry specifically for physical mapping.** The detailed analysis of sequence we use is also highly unique and novel. Instead of identifying the sequence of every base pair in these long fragments, we label and detect specific sequence patterns or motifs that occur universally across every genome with an average frequency of approximately one site for every few thousand base pairs.
- **Bioinformatic tools for structural variation analysis.** Finally, our approach includes a novel bioinformatics platform that we developed from the ground-up to take advantage of the unique benefits of our solution. It comprises proprietary algorithms for the construction of a structurally accurate physical map of the genome without using a reference genome in assignment of structure. Physical maps of a test subject are then compared in cross-mapping analysis that allows our system to detect genome wide structural variation, including the most complex balanced events.

#### **Our Focus Areas**

Our Saphyr system serves many segments of the genomics market seeking to find and understand structural variation. We have identified focus areas where we concentrate our resources to ensure robust adoption of our system and frequent utilization of consumables. We have selected these segments because of their urgent need to detect structural variations and the significant economic opportunity they represent. Our current focus areas are human genetic diseases, including rare diseases and oncology.

- **Rare diseases.** In genetic disease, existing tools have reached a plateau where almost half of patients with genetic disease who are tested in clinical laboratories fail to receive a molecular diagnosis. In order to increase diagnostic yield, a massive increase in the understanding of the complete structure and variation of the genome is essential.
- **Cancer.** In cancer, each patient has a unique disease with a complex pattern of genome changes. Traditional and recently-developed treatments do not attack the individual changes in each patient's tumor. Recent personalized medicine programs aim to provide clinicians with individual treatments specifically targeting the mutations found in each patient's cancer. For personalized cancer medicine to be successful, all variants in the cancer genome need to be detected, which is not feasible with cytogenetic or whole genome sequencing approaches.

Our Saphyr system, which is for RUO, is being used for basic and translational research and also beginning to be adopted by cytogenetics labs that seek to use it in commercial clinical tests of its patients as an LDT.

#### **Our Strengths**

We have established ourselves as one of the leaders in the field of genome analysis, and we believe we are the industry's performance leader in structural variation detection. Below are our strengths that we believe will enable us to capture a significant portion of the genome analysis market and retain our leadership position in structural variation:

- **Highly differentiated technology platform enables researchers and clinicians to obtain information that cannot be had systematically and cost efficiently from traditional technologies.** Saphyr's unique ability to systematically and cost efficiently see structural variations across the genome from 500 base pairs to tens of millions of base pairs is unique in the industry. We believe this greater insight will facilitate a paradigm shift in healthcare from an emphasis on treatment with relatively untargeted therapies to a focus on earlier detection, more precise diagnosis and treatment with better targeted therapies.
- **Validated solution recognized industry-wide.** We have deep and expanding scientific validation as evidenced by the quickly expanding base of publications regarding our system. We believe our technology is becoming a vital tool in cutting-edge life sciences research.



- **Strong installed base of premier customers.** We have sold more than 90 of our systems to over 80 customers globally, including some of the world's most prominent clinical, translational research, basic research, academic and government institutions as well as leading pharmaceutical and diagnostic companies.
- **Attractive business model with a growing, high-margin recurring revenue component.** As we continue to grow our installed base of Saphyr systems, optimize workflows and expand our structural variation detection capabilities, we expect to rapidly increase our high-margin revenues derived from consumables.
- **Industry-leading intellectual property portfolio.** We have developed a global patent portfolio that includes 43 issued patents across 14 patent families and an exclusively licensed portfolio of patents and applications from Princeton University, which includes 22 patents across two families. This global patent portfolio has filing dates ranging from 2001 to 2017.
- **Highly experienced senior management team.** We are led by a dedicated and highly experienced senior management team with significant industry experience and proven ability to develop novel solutions. Each of the members of our senior management has more than 20 years of relevant experience.

### **Our Strategy**

Our goal is to enable new research in genomics to allow greater insight into their role in human health in ways that have not been possible with any other current research and diagnostic technologies.

Our strategy to achieve this includes:

- drive adoption of Saphyr in discovery research and cytogenetics markets;
- support the publication of findings with Saphyr by our customers and partners;
- expand gross margins through economies of scale and growing sales of consumables;
- continue to innovate our products and technologies; and
- partner with industry-leading companies and laboratories to accelerate adoption in clinical markets.

### **Risk Factors Summary**

Investing in our securities involves substantial risk. The risks described under the heading "Risk Factors" immediately following this summary may cause us to not realize the full benefits of our strengths or may cause us to be unable to successfully execute all or part of our strategy. Some of the more significant challenges include the following:

- we have incurred losses since we were formed and expect to incur losses in the future. We cannot be certain that we will achieve or sustain profitability;
- our quarterly and annual operating results and cash flows have fluctuated in the past and might continue to fluctuate, which could cause the market price of our securities to decline substantially;
- we are an early, commercial-stage company and have a limited operating history, which may make it difficult to evaluate our current business and predict our future performance;
- if we are unable to maintain adequate revenue growth or do not successfully manage such growth, our business and growth prospects will be harmed;

- our future capital needs are uncertain and we may need to raise additional funds in the future;
- if our products fail to achieve and sustain sufficient market acceptance, our revenue will be adversely affected;
- our future success is dependent upon our ability to further penetrate our existing customer base and attract new customers;
- we are currently limited to “research use only” with respect to many of the materials and components used in our consumable products including our assays;
- in the near term, our business will depend on levels of research and development spending by academic and governmental research institutions and biopharmaceutical companies, a reduction in which could limit demand for our products and adversely affect our business and operating results;
- if we do not successfully manage the development and launch of new products, our financial results could be adversely affected;
- if the U.S. Food and Drug Administration determines that our products are medical devices or if we seek to market our products for clinical diagnostic or health screening use, we will be required to obtain regulatory clearance(s) or approval(s), and may be required to cease or limit sales of our then marketed products, which could materially and adversely affect our business, financial condition and results of operations. Any such regulatory process would be expensive, time-consuming and uncertain both in timing and in outcome;
- if we are unable to protect our intellectual property, it may reduce our ability to maintain any technological or competitive advantage over our competitors and potential competitors, and our business may be harmed; and
- our principal stockholders and management own a significant percentage of our stock and will be able to exert significant control over matters subject to stockholder approval.

#### **Corporate Information**

We were formed in January 2003 as BioNanomatrix LLC, a Delaware limited liability company. In August 2007, we became BioNanomatrix Inc., a Delaware corporation. In October 2011, we changed our name to BioNano Genomics, Inc., and in July 2018, we changed our name to Bionano Genomics, Inc.

Our principal executive offices are located at 9640 Towne Centre Drive, Suite 100, San Diego, California 92121, and our telephone number is (858) 888-7600. Our website address is [www.bionanogenomics.com](http://www.bionanogenomics.com). Information contained in, 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. Our design logo, “Bionano,” and our other registered and common law trade names, trademarks and service marks are the property of Bionano Genomics, Inc.

We are an “emerging growth company” as defined in the Jumpstart Our Business Startups Act of 2012, or the JOBS Act. We may take advantage of certain exemptions from various public company reporting requirements, including not being required to have our internal control over financial reporting audited by our independent registered public accounting firm under Section 404 of the Sarbanes-Oxley Act of 2002, reduced disclosure obligations regarding executive compensation in our periodic reports and proxy statements, and exemptions from the requirements of holding a nonbinding advisory vote on executive compensation and any golden parachute payments. We may take advantage of these exemptions for up to five years or until we are no longer an “emerging growth company,” whichever is earlier. In particular, in this prospectus, we have provided

only two years of audited financial statements and have not included all of the executive compensation related information that would be required if we were not an emerging growth company. Accordingly, the information contained herein may be different than the information you receive from other public companies in which you hold stock.

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 new or revised accounting standards that have different transition dates for public and private companies until those standards would otherwise apply to private companies. We have elected to use this extended transition period. As a result of this election, our timeline to comply with these standards will in many cases be delayed as compared to other public companies that are not eligible to take advantage of this election or have not made this election. Therefore, our financial statements may not be comparable to those of companies that comply with the public company effective dates for these standards.

**The Offering**

Securities offered by us	3,360,000 units, each consisting of one share of common stock and one warrant to purchase one share of common stock. Each warrant to purchase common stock contained in a unit entitles the holder to purchase one share of our common stock at an initial exercise price of \$6.125 per share (100% of the offering price per unit), subject to adjustment. Each such warrant will become exercisable 30 days after the date of this prospectus or on such date the underwriters separate the units, whichever date is earlier, and will expire five years from the date of this prospectus.
Common stock to be outstanding after this offering	9,491,432 shares (including shares included in the units but excluding shares underlying the warrants included in the units)
Option to purchase additional units offered by us	504,000 units
Use of proceeds	We estimate that our net proceeds from this offering will be \$17.3 million (or approximately \$20.2 million if the underwriters' option to purchase additional units from us is exercised in full), after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. We intend to use the net proceeds we receive from this offering to expand our commercial capabilities in selling and marketing related to our products, to fund our ongoing research and development activities, and for general corporate purposes, including working capital, operating expenses and capital expenditures. See "Use of Proceeds" for additional information.
Risk factors	You should carefully read and consider the information in the section titled "Risk Factors" and all other information set forth in this prospectus before deciding to purchase any units.
Nasdaq trading symbols	Our units, common stock and warrants have been approved for listing on the Nasdaq Stock Market LLC under the symbols "BNGOU," "BNGO" and "BNGOW," respectively.

The number of shares of our common stock to be outstanding after this offering is based on 2,928,325 shares of our common stock as of June 30, 2018, after giving effect to the conversion of shares of our convertible preferred stock outstanding as of June 30, 2018 into an aggregate of 2,850,280 shares of our common stock immediately prior to the closing of this offering, and excludes:

- 416,937 shares of our common stock issuable upon the exercise of stock options outstanding as of June 30, 2018 under our Amended and Restated 2006 Equity Compensation Plan, as amended, or 2006 Plan, with a weighted-average exercise price of \$5.05 per share;
- 1,499,454 shares of our common stock reserved for future issuance under our 2018 Equity Incentive Plan, or 2018 Plan, which will become effective once the registration statement of which this prospectus forms a part is declared effective, with such shares including 1,000,000 new shares plus the

number of shares (not to exceed 499,454 shares) (i) that remain available for the issuance of awards under our 2006 Plan at the time our 2018 Plan becomes effective, and (ii) any shares underlying outstanding stock awards granted under our 2006 Plan that expire or are repurchased, forfeited, cancelled or withheld, as more fully described in the section titled “Executive Compensation – Equity Incentive Plans”;

- 175,000 shares of our common stock reserved for issuance under our 2018 Employee Stock Purchase Plan, or ESPP, which will become effective once the registration statement of which this prospectus forms a part is declared effective, and any automatic increases in the number of shares of common stock reserved for future issuance under our ESPP;
- 1,001 shares of our common stock issuable upon the exercise of an outstanding warrant which, prior to the completion of this offering, is exercisable for 42,872 shares of our Series B convertible preferred stock;
- 1,752 shares of our common stock issuable upon the exercise of outstanding warrants which, prior to the completion of this offering, are exercisable for 75,027 shares of our Series B-1 convertible preferred stock;
- 11,925 shares of our common stock issuable upon the exercise of an outstanding warrant which, prior to the completion of this offering, is exercisable for 510,417 shares of our Series D convertible preferred stock;
- 21,416 shares of our common stock issuable upon the exercise of outstanding warrants which, prior to the completion of this offering, are exercisable for 916,667 shares of our Series D-1 convertible preferred stock; and
- up to 115,920 shares of common stock issuable upon exercise of warrants to be issued to the Underwriters in connection with this offering, which will have an exercise price per share equal to 150% of the initial public offering price per unit in this offering.

Unless we specifically state otherwise, the information in this prospectus assumes or gives effect to:

- the filing of our amended and restated certificate of incorporation, which will be in effect upon the completion of this offering;
- the conversion of all of our outstanding shares of convertible preferred stock into an aggregate of 2,850,280 shares of common stock upon the closing of this offering;
- the conversion of outstanding convertible promissory notes and a conversion date of June 30, 2018 into 3,203,107 shares of common stock (based on the initial public offering price of \$6.125 per unit and a conversion date of June 30, 2018);
- that the initial public offering price of our units is \$6.125 per unit;
- no exercise of the outstanding options described above;
- no exercise of the underwriters’ option to purchase up to an additional 504,000 units from us in this offering; and
- a 1-for-21.4 reverse stock split of our common stock effected on July 16, 2018 and a subsequent 1-for-2 reverse stock split of our common stock effected on August 15, 2018.

Certain of our existing stockholders, including entities affiliated with them or with certain of our directors, have indicated an interest in purchasing an aggregate of approximately \$13.0 million in units in this offering at the initial public offering price per unit. However, because indications of interest are not binding agreements or

commitments to purchase, the underwriters may determine to sell more, less or no units in this offering to any of these persons or entities, or any of these persons or entities may determine to purchase more, less or no units in this offering. The underwriters will receive the same underwriting discount on any units purchased by these persons or entities as they will on any other units sold to the public in this offering.

### Summary Financial Data

The summary statement of operations data for the years ended December 31, 2016 and 2017 and the balance sheet data as of December 31, 2017 are derived from our audited financial statements that are included elsewhere in this prospectus. The summary statement of operations data for the six months ended June 30, 2017 and 2018 and the balance sheet data as of June 30, 2018 are derived from our unaudited financial statements that are included elsewhere in this prospectus. Our historical results are not necessarily indicative of our results in any future period and results from our interim period may not necessarily be indicative of the results of the entire year.

You should read the following summary financial data together with “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and our financial statements and the related notes included elsewhere in this prospectus. The summary financial data in this section are not intended to replace our financial statements and the related notes and are qualified in their entirety by the financial statements and related notes included elsewhere in this prospectus.

	Year ended December 31,		Six Months Ended June 30,	
	2016	2017	2017	2018
			(unaudited)	
Total revenue	\$ 6,792,789	\$ 9,505,043	\$ 3,916,864	\$ 5,158,494
Operating expenses				
Cost of revenue	3,578,692	6,030,512	2,844,117	2,654,879
Research and development	11,431,941	12,009,170	6,584,614	4,465,919
Selling, general and administrative	12,950,572	14,079,658	7,436,426	6,385,378
Impairment of property and equipment	—	604,511	—	—
Total operating expenses	27,961,205	32,723,851	16,865,157	13,506,176
Interest expense	(470,072)	(590,927)	(286,095)	(709,616)
Other income	2,802,797	462,923	896,758	1,907,742
Provision for income taxes	(12,924)	(18,552)	(22,358)	(9,282)
Net loss	<u>\$ (18,848,615)</u>	<u>\$ (23,365,364)</u>	<u>\$ (12,359,988)</u>	<u>\$ (7,158,838)</u>
Net loss per share <sup>(1)</sup> :				
Basic and diluted	\$ (312.46)	\$ (327.78)	\$ (176.12)	\$ (92.23)
Pro forma net loss per share <sup>(1)</sup> :				
Basic and diluted		\$ (8.65)		\$ (1.37)

- (1) See Note 2 to our financial statements included elsewhere in this prospectus for a description of how we compute basic and diluted net income per share attributable to common stockholders and preferred stockholders and pro forma basic and diluted net loss per share attributable to common stockholders.

	As of June 30, 2018		
	Actual	Pro Forma(1) (unaudited)	Pro Forma As Adjusted(2)
<b>Balance Sheet Data:</b>			
Cash and cash equivalents	\$ 7,624,289	\$ 7,624,289	\$ 24,948,189
Working capital(3)	(6,773,417)	9,161,262	26,485,162
Total assets	18,094,156	18,094,156	35,418,056
Convertible note	14,329,843	—	—
Long-term debt	8,956,143	8,956,143	8,956,143
Total liabilities	32,361,630	16,426,951	16,426,951
Convertible preferred stock	43,010,137	—	—
Accumulated deficit	(61,424,874)	(61,424,874)	(61,424,874)
Total stockholders' (deficit) equity	(57,277,611)	1,667,205	18,991,105

- (1) The pro forma balance sheet data gives effect to (i) the automatic conversion of all of our outstanding shares of convertible preferred stock into an aggregate of 2,850,280 shares of common stock, and (ii) the conversion of approximately \$14.4 million aggregate principal amount of outstanding convertible promissory notes plus accrued interest thereon into 3,203,107 shares of common stock (based on the initial public offering price of \$6.125 per unit and a conversion date of June 30, 2018).
- (2) The pro forma as adjusted balance sheet data reflects (i) the items described in footnote (1) above and (ii) our receipt of estimated net proceeds from the sale of 3,360,000 units at the initial public offering price of \$6.125 per unit, after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us.
- (3) Working capital is calculated as current assets minus current liabilities.

## RISK FACTORS

*Investing in our securities 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 financial statements and related notes appearing at the end of this prospectus, before making an investment decision. The risks described below are not the only ones facing us. 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 securities 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 financial condition and need for additional capital**

***We have incurred losses since we were formed and expect to incur losses in the future. We cannot be certain that we will achieve or sustain profitability.***

We incurred net losses of \$18.8 million and \$23.4 million for the years ended December 31, 2016 and 2017, respectively. We incurred net losses of \$12.4 million and \$7.2 million for the six months ended June 30, 2017 and 2018, respectively. As of June 30, 2018, we had an accumulated deficit of \$61.4 million. We cannot predict if we will achieve sustained profitability in the near future or at all. We expect that our losses will continue for the foreseeable future as we plan to invest significant additional funds toward expansion of our commercial organization and the development of our technology. In addition, as a public company, we will incur significant legal, accounting, and other expenses that we did not incur as a private company. These increased expenses will make it harder for us to achieve and sustain future profitability. We may incur significant losses in the future for a number of reasons, many of which are beyond our control, including the other risks described in this prospectus, the market acceptance of our products, future product development and our market penetration and margins.

***Our quarterly and annual operating results and cash flows have fluctuated in the past and might continue to fluctuate, which could cause the market price of our securities to decline substantially.***

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

Our operating results have varied in the past. In addition to other risk factors listed in this section, some of the important factors that may cause fluctuations in our quarterly and annual operating results include:

- adoption of our systems and related products;
- the timing of customer orders to purchase our systems;
- the rate of utilization of consumables by our customers;
- receipt and timing of revenue for services provided by our data solutions service;



- the timing of the introduction of new systems, products, system and product enhancements and services; and
- the receipt and timing of revenue from our distribution and marketing arrangements.

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

***We are an early, commercial-stage company and have a limited operating history, which may make it difficult to evaluate our current business and predict our future performance.***

We are an early, commercial-stage company and have a limited commercial history. Our limited commercial history may make it difficult to evaluate our current business and makes predictions about our future success or viability subject to significant uncertainty. We will continue to encounter risks and difficulties frequently experienced by early, commercial-stage companies, including scaling up our infrastructure and headcount. If we do not address these risks successfully, our business will suffer.

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

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

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

If our management is unable to effectively manage our anticipated growth, our expenses may increase more than expected, our revenue could decline or grow more slowly than expected and we may be unable to implement our business strategy. The quality of our products and services may suffer, which could negatively affect our reputation and harm our ability to retain and attract customers.

***Our future capital needs are uncertain and we may need to raise additional funds in the future.***

We believe that the net proceeds from this offering, together with our cash generated from commercial sales and our existing cash and cash equivalents, including the proceeds from our recent financings, will enable us to fund our operating expenses and capital expenditure requirements for at least the next 18 months, as further described in the section entitled “Management’s Discussion and Analysis of Financial Condition and Results of Operations—Capital Resources.” However, we may need to raise substantial additional capital to:

- expand our sales and marketing efforts to further commercialize our products;

- expand our research and development efforts to improve our existing products and develop and launch new products, particularly if any of our products are deemed by the U.S. Food and Drug Administration, or FDA, to be medical devices or otherwise subject to additional regulation by the FDA;
- seek FDA approval to market our existing products or new products utilized for diagnostic purposes;
- lease a larger facility or build out our existing facility as we continue to grow our employee headcount;
- hire additional personnel;
- enter into collaboration arrangements, if any, or in-license other products and technologies;
- add operational, financial and management information systems; and
- incur increased costs as a result of operating as a public company.

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

- market acceptance of our products;
- the cost and timing of establishing additional sales, marketing and distribution capabilities;
- the cost of our research and development activities;
- the success of our existing distribution and marketing arrangements and our ability to enter into additional arrangements in the future; and
- the effect of competing technological and market developments.

We cannot assure you that we will be able to obtain additional funds on acceptable terms, or at all. If we raise additional funds by issuing equity or equity-linked securities, our stockholders may experience dilution. Future debt financing, if available, may involve covenants restricting our operations or our ability to incur additional debt. Any debt or equity financing may contain terms that are not favorable to us or our stockholders. If we raise additional funds through collaboration and licensing arrangements with third parties, it may be necessary to relinquish some rights to our technologies or our products, or grant licenses on terms that are not favorable to us. If we do not have, or are not able to obtain, sufficient funds, we may have to delay development or commercialization of our products. We also may have to reduce marketing, customer support or other resources devoted to our products or cease operations. Any of these factors could have a material adverse effect on our financial condition, operating results and business.

***The recently passed comprehensive tax reform bill could adversely affect our business and financial condition.***

On December 22, 2017, President Trump signed into law new legislation that significantly revises the Internal Revenue Code of 1986, as amended. The newly enacted federal income tax law, among other things, contains 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 earnings (except for certain small businesses), limitation of the deduction for net operating losses 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 (including reducing the business tax credit for certain clinical testing expenses incurred in the testing of certain drugs for rare diseases or conditions). Notwithstanding the reduction in the corporate income tax rate, the overall impact of the new federal tax law is uncertain, and our business and financial condition could be adversely affected. In addition, it is unknown if and to what extent various states will conform to the newly enacted federal tax law. The impact of this tax reform on holders of our securities is likewise 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 securities.

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

As of June 30, 2018, we had aggregate U.S. net operating loss carryforwards of approximately \$30.5 million and aggregate U.S. research and development credits of approximately \$4.1 million. These net operating loss carryforwards could expire unused and be unavailable to offset future income tax liabilities. Under the newly enacted federal income tax law, 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 newly enacted federal tax law. In addition, under Sections 382 and 383 of the Internal Revenue Code of 1986, as amended, 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 to offset its post-change income or taxes may be limited. We have experienced an ownership change in the past and we may also experience additional 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.

***U.S. taxation of international business activities or the adoption of tax reform policies could materially impact our future financial position and results of operations.***

Limitations on the ability of taxpayers to claim and utilize foreign tax credits and the deferral of certain tax deductions until earnings outside of the U.S. are repatriated to the U.S., as well as changes to U.S. tax laws that may be enacted in the future, could impact the tax treatment of future foreign earnings. Should the scale of our international business activities expand, any changes in the U.S. taxation of such activities could increase our worldwide effective tax rate and harm our future financial position and results of operations.

***The terms of our credit facility place restrictions on our operating and financial flexibility, and failure to comply with covenants or to satisfy certain conditions of the agreement governing the credit facility may result in acceleration of our repayment obligations and foreclosure on our pledged assets, which could significantly harm our liquidity, financial condition, operating results, business and prospects and cause the price of our securities to decline.***

In June 2018, we entered into a credit and security agreement with Midcap Financial Trust, or Midcap, that is secured by a lien covering substantially all of our assets, including intellectual property. The credit and security agreement provides for a five year \$15 million term loan facility, of which we drew \$10 million at closing. The remaining \$5 million may be drawn upon satisfaction of certain conditions. The loan and security agreement governing the credit facility requires us to comply with a number of covenants (affirmative and negative), including restrictive covenants that limit our ability to: incur additional indebtedness; encumber the collateral securing the loan; acquire, own or make investments; repurchase or redeem any class of stock or other equity interest; declare or pay any cash dividend or make a cash distribution on any class of stock or other equity interest; transfer a material portion of our assets; acquire other businesses; and merge or consolidate with or into any other organization or otherwise suffer a change in control, in each case subject to exceptions. Our intellectual property is also subject to customary negative covenants. In addition, subject to limited exceptions, Midcap could declare an event of default upon the occurrence of any event that it interprets as having a material adverse effect upon our business, operations, properties, assets, or financial condition or upon our ability to perform or pay the secured obligations under the loan and security agreement or upon the collateral or Midcap’s liens on the collateral under the agreement, thereby requiring us to repay the loan immediately, together with a prepayment charge of up to 4% of the then outstanding principal balance, together with other fees.

If we default under the credit facility, Midcap may accelerate all of our repayment obligations and, if we are unable to access funds to meet those obligations or to renegotiate our agreement, Midcap could take control of our pledged assets and we could immediately cease operations. If we were to renegotiate our agreement under

such circumstances, the terms may be significantly less favorable to us. If we were liquidated, Midcap's right to repayment would be senior to the rights of our stockholders to receive any proceeds from the liquidation. Any declaration by Midcap of an event of default could significantly harm our liquidity, financial condition, operating results, business, and prospects and cause the price of our securities to decline.

We may incur additional indebtedness in the future. The debt instruments governing such indebtedness may contain provisions that are as, or more, restrictive than the provisions governing our existing indebtedness under the credit and security agreement with Midcap. If we are unable to repay, refinance or restructure our indebtedness when payment is due, the lenders could proceed against the collateral or force us into bankruptcy or liquidation.

**Risks related to our business**

***If our products fail to achieve and sustain sufficient market acceptance, our revenue will be adversely affected.***

Our success depends on our ability to develop and market products that are recognized and accepted as reliable, enabling and cost-effective. Most of the potential customers for our products already use expensive research systems in their laboratories that they have used for many years and may be reluctant to replace those systems with ours. Market acceptance of our systems will depend on many factors, including our ability to convince potential customers that our technology is an attractive alternative to existing technologies. Compared to some competing technologies, our technology is new and complex, and many potential customers have limited knowledge of, or experience with, our products. Prior to adopting our systems, some potential customers may need to devote time and effort to testing and validating our systems. Any failure of our systems to meet these customer benchmarks could result in potential customers choosing to retain their existing systems or to purchase systems other than ours. In addition, it is important that our gene mapping systems be perceived as accurate and reliable by the scientific and medical research community as a whole. Historically, a significant part of our sales and marketing efforts has been directed at demonstrating the advantages of our technology to industry leaders and encouraging such leaders to publish or present the results of their evaluation of our system. If we are unable to continue to motivate leading researchers to use our technology, or if such researchers are unable to achieve or unwilling to publish or present significant experimental results using our systems, acceptance and adoption of our systems will be slowed and our ability to increase our revenue would be adversely affected.

***Our future success is dependent upon our ability to further penetrate our existing customer base and attract new customers.***

Our current customer base is primarily composed of academic and governmental research institutions, as well as biopharmaceutical and contract research companies. Our success will depend upon our ability to respond to the evolving needs of, and increase our market share among, existing customers and additional potential customers, marketing new products as we develop them. Identifying, engaging and marketing to customers who are unfamiliar with our current products requires substantial time, expertise and expense and involves a number of risks, including:

- our ability to attract, retain and manage the sales, marketing and service personnel necessary to expand market acceptance for our technology;
- the time and cost of maintaining and growing a specialized sales, marketing and service force; and
- our sales, marketing and service force may be unable to execute successful commercial activities.

We have utilized third parties to assist with sales, distribution and customer support in certain regions of the world. There is no guarantee, when we enter into such arrangements, that we will be successful in attracting desirable sales and distribution partners. There is also no guarantee that we will be able to enter into such arrangements on favorable terms. Any failure of our sales and marketing efforts, or those of any third-party sales and distribution partners, would adversely affect our business.

***We are currently limited to “research use only” with respect to many of the materials and components used in our consumable products including our assays.***

Our instruments, consumable products and assays are purchased from suppliers with a restriction that they be used for research use only, or RUO. While we have focused initially on the life sciences research market and RUO products only, part of our business strategy is to expand our product line to encompass products that are intended to be used for the diagnosis of disease and precision healthcare, either alone or in collaboration with third parties. The use of our products for any such diagnostic purposes would require that we obtain regulatory clearance or approval to market our products for those purposes and also that we acquire the materials and components used in such products from suppliers without an RUO restriction. There can be no assurance that we will be able to acquire these materials and components for use in diagnostic products on acceptable terms, if at all. If we are unable to do so, we would not be able to expand our product offerings beyond RUO, and our business and prospects would suffer.

The FDA Guidance on “Distribution of In Vitro Diagnostic Products Labeled for Research Use Only or Investigational Use Only”, or, the RUO/IUO Labeling Guidance, emphasizes that the FDA will review the totality of the circumstances when evaluating whether equipment and testing components are properly labeled as RUO. It further states that merely including a labeling statement that a product is intended for research use only will not necessarily render the device exempt from the FDA’s 510(k) clearance, PMA, or other requirements, if the circumstances surrounding the distribution of the product indicate that the manufacturer intends for its product to be offered for clinical diagnostic use. These circumstances may include written or verbal marketing claims or links to articles regarding a product’s performance in clinical applications, a manufacturer’s provision of technical support for clinical validation or clinical applications, or solicitation of business from clinical laboratories, all of which could be considered evidence of intended uses that conflict with RUO labeling. If the FDA were to determine that our RUO products were intended for use in clinical investigation, diagnosis or treatment decisions, or that express or implied clinical or diagnostic claims were made for our RUO products, those products could be considered misbranded or adulterated under the Federal Food, Drug, and Cosmetic Act. If the FDA determines that our RUO products are being marketed for clinical diagnostic use without the required PMA or 510(k) clearance, we may be required to cease marketing our products as planned, recall the products from customers, revise our marketing plans, and/or suspend or delay the commercialization of our products until we obtain the required authorization. We also may be subject to a range of enforcement actions by the FDA, including warning or untitled letters, injunctions, civil monetary penalties, criminal prosecution, and recall and/or seizure of products, as well as significant adverse publicity.

If, in the future, we choose to commercialize our products for clinical diagnostic use, we will be required to comply with the FDA’s premarket review and post-market control requirements for IVDs, as may be applicable. Complying with the FDA’s PMA and/or 510(k) clearance requirements may be expensive, time-consuming, and subject us to significant and/or unanticipated delays. Our efforts may never result in an approved PMA or 510(k) clearance for our products. Even if we obtain a PMA or 510(k) clearance, where required, such authorization may not be for the use or uses we believe are commercially attractive and/or are critical to the commercial success of our products. As a result, being subject to the FDA’s premarket review and/or post-market control requirements for our products could materially and adversely affect our business, financial condition and results of operations.

***In the near term, our business will depend on levels of research and development spending by academic and governmental research institutions and biopharmaceutical companies, a reduction in which could limit demand for our products and adversely affect our business and operating results.***

In the near term, we expect that our revenue will be derived primarily from sales of our instruments and consumables to academic and governmental research institutions, as well as biopharmaceutical and contract research companies worldwide for research applications. The demand for our products will depend in part upon

the research and development budgets of these customers, which are impacted by factors beyond our control, such as:

- changes in government programs that provide funding to research institutions and companies;
- macroeconomic conditions and the political climate;
- changes in the regulatory environment;
- differences in budgetary cycles; and
- market acceptance of relatively new technologies, such as ours.

For example, in March 2017, the federal government announced the intent to cut federal biomedical research funding by as much as 18%. While there has been significant opposition to these funding cuts, the uncertainty regarding the availability of research funding for potential customers may adversely affect our operating results. Our operating results may fluctuate substantially due to reductions and delays in research and development expenditures by these customers. Any decrease in customers' budgets or expenditures, or in the size, scope or frequency of capital or operating expenditures, could materially and adversely affect our business, operating results and financial condition.

***The sales cycle for our systems can be lengthy and variable, which makes it difficult for us to forecast revenue and other operating results.***

The sales process for our systems generally involves numerous interactions with multiple individuals within an organization, and often includes in-depth analysis by potential customers of our technology and products and a lengthy review process. Our customers' evaluation processes often involve a number of factors, many of which are beyond our control. As a result of these factors, the capital investment required to purchase our systems and the budget cycles of our customers, the time from initial contact with a customer to our receipt of a purchase order can vary significantly. Given the length and uncertainty of our sales cycle, we have in the past experienced, and expect to in the future experience, fluctuations in our sales on a period-to-period basis. In addition, any failure to meet customer expectations could result in customers choosing to retain their existing systems, use existing assays not requiring capital equipment or purchase systems other than ours.

***Our long-term results depend upon our ability to improve existing products and introduce and market new products successfully.***

Our business is dependent on the continued improvement of our existing products and our development of new products utilizing our current or other potential future technology. As we introduce new products or refine, improve or upgrade versions of existing products, we cannot predict the level of market acceptance or the amount of market share these products will achieve, if any. We cannot assure you that we will not experience material delays in the introduction of new products in the future. For example, the introduction of our Saphyr system replaced our Irys system, and as a result we may never sell the remaining Irys units currently in our inventory. Therefore, we may from time to time determine it necessary to write down or write off units of our Irys inventory.

Consistent with our strategy of offering new products and product refinements, we expect to continue to use a substantial amount of capital for product development and refinement. We may need additional capital for product development and refinement than is available on terms favorable to us, if at all, which could adversely affect our business, financial condition or results of operations.

We generally sell our products in industries that are characterized by rapid technological changes, frequent new product introductions and changing industry standards. If we do not develop new products and product enhancements based on technological innovation on a timely basis, our products may become obsolete over time

and our revenues, cash flow, profitability and competitive position will suffer. Our success will depend on several factors, including our ability to:

- correctly identify customer needs and preferences and predict future needs and preferences;
- allocate our research and development funding to products with higher growth prospects;
- anticipate and respond to our competitors' development of new products and technological innovations;
- innovate and develop new technologies and applications, and acquire or obtain rights to third-party technologies that may have valuable applications in the markets we serve;
- successfully commercialize new technologies in a timely manner, price them competitively and manufacture and deliver sufficient volumes of new products of appropriate quality on time; and
- convince customers to adopt new technologies.

In addition, if we fail to accurately predict future customer needs and preferences or fail to produce viable technologies, we may invest heavily in research and development of products that do not lead to significant revenue. Even if we successfully innovate and develop new products and product enhancements, we may incur substantial costs in doing so, and our profitability may suffer.

Our ability to develop new products based on innovation can affect our competitive position and often requires the investment of significant resources. Difficulties or delays in research, development or production of new products and services or failure to gain market acceptance of new products and technologies may reduce future revenues and adversely affect our competitive position.

***If we do not successfully manage the development and launch of new products, our financial results could be adversely affected.***

We face risks associated with launching new products. If we encounter development or manufacturing challenges or discover errors during our product development cycle, the product launch dates of new products may be delayed. The expenses or losses associated with unsuccessful product development or launch activities or lack of market acceptance of our new products could adversely affect our business or financial condition.

***Undetected errors or defects in our products could harm our reputation, decrease market acceptance of our products or expose us to product liability claims.***

Our products may contain undetected errors or defects when first introduced or as new versions or new products are released. Disruptions affecting the introduction or release of, or other performance problems with, our products may damage our customers' businesses and could harm their and our reputation. If that occurs, we may incur significant costs, the attention of our key personnel could be diverted, or other significant customer relations problems may arise. We may also be subject to warranty and liability claims for damages related to errors or defects in our products. In addition, if we do not meet industry or quality standards, if applicable, our products may be subject to recall. A material liability claim, recall or other occurrence that harms our reputation or decreases market acceptance of our products could harm our business and operating results.

Although we do not, and cannot currently, promote the use of our products, or services based on our products, for diagnostic purposes, if our customers develop or use them for diagnostic purposes, someone could file a product liability claim alleging that one of our products contained a design or manufacturing defect that resulted in the failure to adequately perform, leading to death or injury. A product liability claim could result in substantial damages and be costly and time consuming to defend, either of which could materially harm our business or financial condition. We cannot assure investors that our product liability insurance would adequately protect our assets from the financial impact of defending a product liability claim. Any product liability claim brought against us, with or without merit, could increase our product liability insurance rates or prevent us from securing insurance coverage in the future.

***Our reliance on distributors for sales of our products outside of the United States could limit or prevent us from selling our products and could impact our revenue.***

We intend to continue to grow our business internationally, and to do so we must attract additional distributors and retain existing distributors to maximize the commercial opportunity for our products. There is no guarantee that we will be successful in attracting or retaining desirable sales and distribution partners or that we will be able to enter into such arrangements on favorable terms. Distributors may not commit the necessary resources to market and sell our products to the level of our expectations or may choose to favor marketing the products of our competitors. If current or future distributors do not perform adequately, or we are unable to enter into effective arrangements with distributors in particular geographic areas, we may not realize long-term international revenue growth. In addition, if our distributors fail to comply with applicable laws and ethical standards, including anti-bribery laws, this could damage our reputation and could have a significant adverse effect on our business and our revenues.

***We expect to generate a substantial portion of our revenue internationally in the future and can become further subject to various risks relating to our international activities, which could adversely affect our business, operating results and financial condition.***

During 2017 approximately 60% of our product revenue was generated from customers located outside of the U.S. We believe that a substantial percentage of our future revenue will come from international sources as we expand our overseas operations and develop opportunities in additional areas. We have limited experience operating internationally and engaging in international business involves a number of difficulties and risks, including:

- required compliance with existing and changing foreign regulatory requirements and laws;
- difficulties and costs of staffing and managing foreign operations;
- difficulties protecting or procuring intellectual property rights;
- required compliance with anti-bribery laws, such as the U.S. Foreign Corrupt Practices Act, data privacy requirements, labor laws and anti-competition regulations;
- export or import restrictions;
- laws and business practices favoring local companies;
- longer payment cycles and difficulties in enforcing agreements and collecting receivables through certain foreign legal systems;
- political and economic instability; and
- potentially adverse tax consequences, tariffs, customs charges, bureaucratic requirements and other trade barriers.

Historically, most of our revenue has been denominated in U.S. dollars. In the future, we may sell our products and services in local currency outside of the U.S. As our operations in countries outside of the U.S. grow, our results of operations and cash flows may be subject to fluctuations due to changes in foreign currency exchange rates, which could harm our business in the future. For example, if the value of the U.S. dollar increases relative to foreign currencies, in the absence of a corresponding change in local currency prices, our revenue could be adversely affected as we convert revenue from local currencies to U.S. dollars. If we dedicate significant resources to our international operations and are unable to manage these risks effectively, our business, operating results and financial condition will suffer.



***We are subject to U.S. and foreign anti-corruption and anti-money laundering laws with respect to our operations and non-compliance with such laws can subject us to criminal and/or civil liability and harm our business.***

We are subject to the U.S. Foreign Corrupt Practices Act, as amended, the U.S. domestic bribery statute contained in 18 U.S.C. § 201, the U.S. Travel Act, the USA PATRIOT Act, the United Kingdom Bribery Act 2010, and other state and national anti-bribery and anti-money laundering laws in countries in which we conduct activities. Anti-corruption laws are interpreted broadly and prohibit companies and their employees and third-party intermediaries from authorizing, promising, offering, providing, soliciting, or accepting, directly or indirectly, improper payments or benefits to or from any person whether in the public or private sector for the purpose of obtaining or retaining business or securing any other improper advantage. We rely on third-party representatives, distributors, and other business partners to support sales of our products and services and our efforts to ensure regulatory compliance. In addition, as we increase our international sales and business, we may engage with additional business partners. We can be held liable for the corrupt or other illegal activities of our employees, representatives, contractors, business partners, and agents, even if we do not explicitly authorize or have actual knowledge of such activities.

Any violations of anti-corruption and anti-money laundering 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.

***We are subject to governmental export and import controls that could impair our ability to compete in international markets due to licensing requirements and subject us to liability if we are not in compliance with applicable laws.***

Our products are subject to export control and import laws and regulations, including the U.S. Export Administration Regulations, U.S. Customs regulations, and various economic and trade sanctions regulations administered by the U.S. Treasury Department's Office of Foreign Assets Controls. Exports of our products must be made in compliance with these laws and regulations. If we fail to comply with these laws and regulations, we and certain of our employees could be subject to substantial civil or criminal penalties, including the possible loss of export or import privileges; fines, which may be imposed on us and responsible employees or managers; and, in extreme cases, the incarceration of responsible employees or managers.

In addition, changes in our products or changes in applicable export or import laws and regulations may create delays in the introduction and sale of our products in international markets, prevent our customers from deploying our products or, in some cases, prevent the export or import of our products to certain countries, governments or persons altogether. Any change in export or import laws and regulations, shift in the enforcement or scope of existing laws and regulations, or change in the countries, governments, persons or technologies targeted by such laws and regulations, could also result in decreased use of our products, or in our decreased ability to export or sell our products to existing or potential customers. Any decreased use of our products or limitation on our ability to export or sell our products would likely adversely affect our business, financial condition and results of operations.

***If we are unable to recruit, train, retain, motivate and integrate key personnel, we may not achieve our goals.***

Our future success depends on our ability to recruit, train, retain, motivate and integrate key personnel, including our recently expanded senior management team, as well as our research and development, manufacturing and sales and marketing personnel. Competition for qualified personnel is intense. Our growth depends, in particular, on attracting and retaining highly-trained sales personnel with the necessary scientific background and ability to understand our systems at a technical level to effectively identify and sell to potential

new customers and develop new products. Because of the complex and technical nature of our products and the dynamic market in which we compete, any failure to attract, train, retain, motivate and integrate qualified personnel could materially harm our operating results and growth prospects.

***We have limited experience in marketing and selling our products, and if we are unable to successfully commercialize our products, our business and operating results will be adversely affected.***

We have limited experience marketing and selling our products. We currently sell all our products for research use only, through our direct field sales and support organizations located in North America and Europe and through a combination of our own sales force and third-party distributors in additional major markets such as Australian, China, Japan and South Korea.

The future sales of our products will depend in large part on our ability to effectively market and sell our products, successfully manage and expand our sales force, and increase the scope of our marketing efforts. We may also enter into additional distribution arrangements in the future. Because we have limited experience in marketing and selling our products, our ability to forecast demand, the infrastructure required to support such demand and the sales cycle to customers is unproven. If we do not build an efficient and effective sales force, our business and operating results will be adversely affected.

***We rely on a single contract manufacturer for our systems and rely on a single contract manufacturer for our chip consumables. If either of these manufacturers should fail or not perform satisfactorily, our ability to supply these instruments would be negatively and adversely affected.***

We currently rely on a single contract manufacturer to manufacture and supply all of our instruments. See “Business–Key Agreements.” In addition, we rely on a single contract manufacturer to manufacture and supply all of our chip consumables. Since our contracts with these manufacturers do not commit them to supply quantities beyond the amounts included in our purchase orders, and do not commit them to carry inventory or make available any particular quantities, these contract manufacturers may give other customers’ needs higher priority than ours, and we may not be able to obtain adequate supplies in a timely manner or on commercially reasonable terms. If either of these manufacturers were to be unable to supply instruments, our business would be harmed.

In the event it becomes necessary to utilize different contract manufacturers for our instruments or chip consumables, we would experience additional costs, delays and difficulties in doing so as a result of identifying and entering into an agreement with a new supplier as well as preparing such new supplier to meet the logistical requirements associated with manufacturing our units, and our business would suffer. We may also experience additional costs and delays in the event we need access to or rights under any intellectual property of these current manufacturers.

***We may experience manufacturing problems or delays that could limit the growth of our revenue or increase our losses.***

We may encounter unforeseen situations that would result in delays or shortfalls in our production as well as delays or shortfalls caused by our outsourced manufacturing suppliers and by other third-party suppliers who manufacture components for our products. If we are unable to keep up with demand for our products, our revenue could be impaired, market acceptance for our products could be adversely affected and our customers might instead purchase our competitors’ products. Our inability to successfully manufacture our products would have a material adverse effect on our operating results.

***We rely on a limited number of suppliers or, in some cases, one supplier, for some of our materials and components used in our consumable products, and may not be able to find replacements or immediately transition to alternative suppliers, which could have a material adverse effect on our business, financial condition, results of operations and reputation.***

We rely on limited or sole suppliers for certain reagents and other materials and components that are used in our consumable products. While we periodically forecast our needs for such materials and enter into standard purchase orders with them, we do not have long-term contracts with many of these suppliers. If we were to lose such suppliers, there can be no assurance that we will be able to identify or enter into agreements with alternative suppliers on a timely basis on acceptable terms, if at all. An interruption in our operations could occur if we encounter delays or difficulties in securing these materials, or if the quality of the materials supplied do not meet our requirements, or if we cannot then obtain an acceptable substitute. The time and effort required to qualify a new supplier and ensure that the new materials provide the same or better quality results could result in significant additional costs. Any such interruption could significantly affect our business, financial condition, results of operations and reputation.

In addition, certain of the components used in our instruments are sourced from limited or sole suppliers. If we were to lose such suppliers, there can be no assurance that we will be able to identify or enter into agreements with alternative suppliers on a timely basis on acceptable terms, if at all. An interruption in our ability to sell and deliver instruments to customers could occur if we encounter delays or difficulties in securing these components, or if the quality of the components supplied do not meet specifications, or if we cannot then obtain an acceptable substitute. If any of these events occur, our business and operating results could be harmed.

***If we cannot provide quality technical and applications support, we could lose customers and our business and prospects will suffer.***

The placement of our products at new customer sites, the introduction of our technology into our customers' existing laboratory workflows and ongoing customer support can be complex. Accordingly, we need highly trained technical support personnel. Hiring technical support personnel is very competitive in our industry due to the limited number of people available with the necessary scientific and technical backgrounds and ability to understand our technology at a technical level. To effectively support potential new customers and the expanding needs of current customers, we will need to substantially expand our technical support staff. If we are unable to attract, train or retain the number of highly qualified technical services personnel that our business needs, our business and prospects will suffer.

***Our business could be negatively impacted by cyber security threats.***

In the ordinary course of our business, we collect and store sensitive data, intellectual property and proprietary business information owned or controlled by ourselves or our customers. We face various cyber security threats, including cyber security attacks to our information technology infrastructure and attempts by others to gain access to our proprietary or sensitive information. This information encompasses a wide variety of business-critical information including research and development information, commercial information, and business and financial information. The procedures and controls we use to monitor these threats and mitigate our exposure may not be sufficient to prevent cyber security incidents. The result of these incidents could include disrupted operations, lost opportunities, misstated financial data, liability for stolen assets or information, increased costs arising from the implementation of additional security protective measures, litigation and reputational damage. Any remedial costs or other liabilities related to cyber security incidents may not be fully insured or indemnified by other means.

***The life sciences research and diagnostic markets are highly competitive. If we fail to effectively compete, our business, financial condition and operating results will suffer.***

We face significant competition in the life sciences research and diagnostic markets. We currently compete with both established and early stage companies that design, manufacture and market systems and consumable

supplies. We believe our principal competitors in the life sciences research and genome mapping markets include Pacific Biosciences of California, Oxford Nanopore Technologies, 10x Genomics, Genomic Vision and Dovetail Genomics. In addition, there are a number of new market entrants in the process of developing novel technologies for the life sciences research, diagnostic and screening markets.

Many of our current competitors are either publicly traded, or are divisions of publicly-traded companies, and may enjoy a number of competitive advantages over us, including:

- greater name and brand recognition;
- substantially greater financial and human resources;
- broader product lines;
- larger sales forces and more established distributor networks;
- substantial intellectual property portfolios;
- larger and more established customer bases and relationships; and
- better established, larger scale, and lower cost manufacturing capabilities.

We believe that the principal competitive factors in all of our target markets include:

- cost of instruments and consumables;
- accuracy, including sensitivity and specificity, and reproducibility of results;
- reputation among customers;
- innovation in product offerings;
- flexibility and ease of use; and
- compatibility with existing laboratory processes, tools and methods.

We cannot assure investors that our products will compete favorably or that we will be successful in the face of increasing competition from new products and technologies introduced by our existing competitors or new companies entering our markets. In addition, we cannot assure investors that our competitors do not have or will not develop products or technologies that currently or in the future will enable them to produce competitive products with greater capabilities or at lower costs than ours. Any failure to compete effectively could materially and adversely affect our business, financial condition and operating results.

***Acquisitions or joint ventures could disrupt our business, cause dilution to our stockholders and otherwise harm our business.***

We may acquire other businesses, products or technologies as well as pursue strategic alliances, joint ventures, technology licenses or investments in complementary businesses. We have not made any acquisitions to date, and our ability to do so successfully is unproven. Any of these transactions could be material to our financial condition and operating results and expose us to many risks, including:

- disruption in our relationships with customers, distributors or suppliers as a result of such a transaction;
- unanticipated liabilities related to acquired companies;
- difficulties integrating acquired personnel, technologies and operations into our existing business;
- diversion of management time and focus from operating our business to acquisition integration challenges;

- increases in our expenses and reductions in our cash available for operations and other uses; and
- possible write-offs or impairment charges relating to acquired businesses.

Foreign acquisitions involve unique risks in addition to those mentioned above, including those related to integration of operations across different cultures and languages, currency risks and the particular economic, political and regulatory risks associated with specific countries.

Also, the anticipated benefit of any acquisition may not materialize. Future acquisitions or dispositions could result in potentially dilutive issuances of our equity securities, the incurrence of debt, contingent liabilities or amortization expenses or write-offs of goodwill, any of which could harm our financial condition. We cannot predict the number, timing or size of future joint ventures or acquisitions, or the effect that any such transactions might have on our operating results.

#### **Risks related to government regulation and diagnostic product reimbursement**

***If the FDA determines that our products are medical devices or if we seek to market our products for clinical diagnostic or health screening use, we will be required to obtain regulatory clearance(s) or approval(s), and may be required to cease or limit sales of our then marketed products, which could materially and adversely affect our business, financial condition and results of operations. Any such regulatory process would be expensive, time-consuming and uncertain both in timing and in outcome.***

We have focused initially on the life sciences research market. This includes laboratories associated with academic and governmental research institutions, as well as pharmaceutical, biotechnology and contract research companies. Accordingly, our products are labeled as “Research Use Only,” or RUO, and are not intended for diagnostic use. While we have focused initially on the life sciences research market and RUO products only, our strategy is to expand our product line to encompass products that are intended to be used for the diagnosis of disease, either alone or in collaboration with third parties (such as our collaboration with Berry Genomics). Such in-vitro diagnostic, or IVD, products will be subject to regulation by the FDA as medical devices, or comparable international agencies, including requirements for regulatory clearance or approval of such products before they can be marketed. If the FDA were to determine that our products are intended for clinical use or if we decided to market our products for such use, we would be required to obtain FDA 510(k) clearance or premarket approval in order to sell our products in a manner consistent with FDA laws and regulations. Such regulatory approval processes or clearances are expensive, time-consuming and uncertain; our efforts may never result in any approved premarket approval application, or PMA, or 510(k) clearance for our products; and failure by us or a collaborator to obtain or comply with such approvals and clearances could have an adverse effect on our business, financial condition or operating results.

IVD products may be regulated as medical devices by the FDA and comparable international agencies and may require either clearance from the FDA following the 510(k) pre-market notification process or PMA from the FDA, in each case prior to marketing. If we or our collaborators are required to obtain a PMA or 510(k) clearance for products based on our technology, we or they would be subject to a substantial number of additional requirements for medical devices, including establishment registration, device listing, Quality Systems Regulations which cover the design, testing, production, control, quality assurance, labeling, packaging, servicing, sterilization (if required), and storage and shipping of medical devices (among other activities), product labeling, advertising, recordkeeping, post-market surveillance, post-approval studies, adverse event reporting, and correction and removal (recall) regulations. One or more of the products we or a collaborator may develop using our technology may also require clinical trials in order to generate the data required for PMA approval. Complying with these requirements may be time-consuming and expensive. We or our collaborators may be required to expend significant resources to ensure ongoing compliance with the FDA regulations and/or take satisfactory corrective action in response to enforcement action, which may have a material adverse effect on the ability to design, develop, and commercialize products using our technology as planned. Failure to comply with these requirements may subject us or a collaborator to a range of enforcement actions, such as warning

letters, injunctions, civil monetary penalties, criminal prosecution, recall and/or seizure of products, and revocation of marketing authorization, as well as significant adverse publicity. If we or our collaborators fail to obtain, or experience significant delays in obtaining, regulatory approvals for IVD products, such products may not be able to be launched or successfully commercialized in a timely manner, or at all.

Laboratory developed tests, or LDTs, are a subset of IVD tests that are designed, manufactured and used within a single laboratory. The FDA maintains that LDTs are medical devices and has for the most part exercised enforcement discretion for most LDTs. A significant change in the way that the FDA regulates any LDTs that we, our collaborators or our customers develop using our technology could affect our business. If the FDA requires laboratories to undergo premarket review and comply with other applicable FDA requirements in the future, the cost and time required to commercialize an LDT will increase substantially, and may reduce the financial incentive for laboratories to develop LDTs, which could reduce demand for our instruments and our other products. In addition, if the FDA were to change the way that it regulates LDTs to require that we undergo pre-market review or comply with other applicable FDA requirements before we can sell our instruments or our other products to clinical cytogenetics laboratories, our ability to sell our instruments and other products to this addressable market would be delayed, thereby impeding our ability to penetrate this market and generate revenue from sales of our instruments and our other products.

Failure to comply with applicable FDA requirements could subject us to misbranding or adulteration allegations under the Federal Food, Drug, and Cosmetic Act. We could be subject to a range of enforcement actions, including warning letters, injunctions, civil monetary penalties, criminal prosecution, and recall and/or seizure of products, as well as significant adverse publicity. In addition, changes to the current regulatory framework, including the imposition of additional or new regulations, could arise at any time during the development or marketing of our products, which may negatively affect our ability to obtain or maintain FDA or comparable regulatory approval of our products, if required.

Foreign jurisdictions have laws and regulations similar to those described above, which may adversely affect our ability to market our products as planned in such countries. The number and scope of these requirements are increasing. As in the U.S., the cost and time required to comply with regulatory requirements may be substantial, and there is no guarantee that we will obtain the necessary authorization(s) required to make our products commercially viable. As a result, the imposition of foreign requirements may also have a material adverse effect on the commercial viability of our operations.

***We expect to rely on third parties in conducting any required future studies of diagnostic products that may be required by the FDA or other regulatory authorities, and those third parties may not perform satisfactorily.***

We do not have the ability to independently conduct clinical trials or other studies that may be required to obtain FDA and other regulatory clearance or approval for future diagnostic products. Accordingly, we expect that we would rely on third parties, such as clinical investigators, consultants, and collaborators to conduct such studies if needed. Our reliance on these third parties for clinical and other development activities would reduce our control over these activities. If these third parties do not successfully carry out their contractual duties or regulatory obligations or meet expected deadlines, if the third parties need to be replaced or if the quality or accuracy of the data they obtain is compromised, we may not be able to obtain regulatory clearance or approval.

***If diagnostic procedures that are enabled by our technology are subject to unfavorable pricing regulations or third-party coverage and reimbursement policies, our business could be harmed.***

Currently, our product is for research use only, but clinical laboratories may acquire our instrumentation through a capital purchase or capital lease and use the Saphyr and direct label stain chemistry to create their own potentially reimbursable products, such as laboratory developed tests for in vitro diagnostics. Our customers may generate revenue for these testing services by seeking the necessary approval of their product from the FDA or the Center for Medicare and Medicaid Services, or CMS, along with coverage and reimbursement from third-

party payors, including government health programs and private health plans. The ability of our customers to commercialize diagnostic tests based on our technology will depend in part on the extent to which coverage and reimbursement for these test will be available from such third-party payors.

In the U.S., molecular testing laboratories have multiple options for reimbursement coding, but we expect that the primary codes used will be the genomic sequencing procedure codes, or GSPs. The American Medical Association, or AMA, added GSPs to its clinical laboratory fee schedule in 2015. In addition, CMS recently issued a coverage determination providing for the reimbursement of next-generation sequencing for certain cancer diagnostics using an FDA-approved in vitro diagnostic test. Private health plans often follow CMS to a substantial degree, and it is difficult to predict what CMS will decide with respect to reimbursement of any products our customers try to commercialize.

In Europe, coverage for molecular diagnostic testing is varied. Countries with statutory health insurance (e.g., Germany, France, The Netherlands) tend to be more progressive in technology adoption with favorable reimbursement for molecular diagnostic testing. In countries such as the United Kingdom with tax-based insurance, adoption and reimbursement for molecular diagnostic testing is not uniform and is influenced by local budgets.

Ultimately, coverage and reimbursement of new products is uncertain, and whether laboratories that use our instruments to develop their own products will attain coverage and adequate reimbursement is unknown. In the U.S., there is no uniform policy for determining coverage and reimbursement. Coverage can differ from payor to payor, and the process for determining whether a payor will provide coverage may be separate from the process for setting the reimbursement rate. In addition, the U.S. government, state legislatures and foreign governments have shown significant interest in implementing cost containment programs to limit the growth of government-paid health care costs, including price controls and restrictions on reimbursement. We cannot be sure that coverage will be available for any diagnostic tests based on our technology, and, if coverage is available, the level of payments. Reimbursement may impact the demand for those tests. If reimbursement is not available or is available only to limited levels, our customers may not be able to successfully commercialize any tests for which they receive marketing authorization.

***Current and future legislation may increase the difficulty and cost to obtain marketing approval of and commercialize any products based on our technology and affect the prices that may be obtained.***

In March 2010, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Affordability Reconciliation Act, collectively, the ACA, became law. The ACA is a sweeping law intended to broaden access to health insurance, reduce or constrain the growth of healthcare spending, enhance remedies against fraud and abuse, add new transparency requirements for the healthcare and health insurance industries, impose new taxes and fees on the health industry and impose additional health policy reforms. The ACA's provisions of importance to our business include, but are not limited to, a 2.3% excise tax on certain entities that manufacture or import medical devices offered for sale in the U.S., with limited exceptions, which has been suspended, but due to subsequent legislative amendments, will be automatically reinstated for medical device sales beginning January 1, 2020, unless Congress takes additional action to delay the implementation of the tax.

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 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 or otherwise circumvent some of the requirements for health insurance mandated by 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, two bills affecting the implementation of certain taxes under the ACA have been signed into law. The 2017 U.S. Tax Cuts and Jobs Act, includes a provision repealing, effective

January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on certain individuals who fail to maintain qualifying health coverage for all or part of a year that is commonly referred to as the “individual mandate”. Additionally, a 2018 continuing resolution on appropriations delays the implementation of certain ACA-mandated fees, including, without limitation, the medical device excise tax.

In addition, other legislative changes have been proposed and adopted since the ACA was enacted. For example, on April 1, 2014, the Protecting Access to Medicare Act of 2014, or PAMA, was signed into law, which, among other things, significantly altered the payment methodology under the Medicare Clinical Laboratory Fee Schedule, or CLFS. PAMA requires certain laboratories performing clinical diagnostic laboratory tests to report to CMS the amounts paid by private payors for laboratory tests. Beginning January 1, 2018, CMS will use reported private payor pricing to periodically revise payment rates under the CLFS.

We expect that the ACA, as well as other healthcare reform measures that may be adopted in the future, may result in more rigorous coverage criteria and additional downward pressure on the price that we or our collaborators will receive for any cleared or approved product. Any reduction in payments from Medicare or other government programs may result in a similar reduction in payments from private payors. The implementation of cost containment measures or other healthcare reforms may prevent our customers from successfully commercializing any tests for which they receive approval, which could prevent us from being able to generate revenue and attain profitability.

In addition, sales of our instruments outside of the U.S. will subject us to foreign regulatory requirements, which may also change over time.

We cannot predict whether future healthcare initiatives will be implemented at the federal or state level or in countries outside of the U.S. in which we may do business, or the effect any future legislation or regulation will have on us. The expansion in government’s effect on the U.S. healthcare industry may result in decreased profits to us, lower reimbursements by payors for our products or reduced medical procedure volumes, all of which may adversely affect our business, financial condition and results of operations.

***We may be subject, directly or indirectly, to federal and state healthcare fraud and abuse laws and other federal and state laws applicable to our marketing practices. If we are unable to comply, or have not complied, with such laws, we could face substantial penalties.***

Our operations are directly or indirectly, through our customers, subject to various federal and state fraud and abuse laws, including, without limitation, the federal and state anti-kickback statutes and false claims laws. These laws may impact, among other things, our sales and marketing and education programs, and our financial and business relationships with researchers who use our instruments to develop marketed products. By way of example: the federal Anti-Kickback Statute prohibits, among other things, any person or entity from, among other things, knowingly and willfully soliciting, receiving, offering or paying any remuneration, directly or indirectly, to induce, or in return for, purchasing, leasing, ordering, or arranging for or recommending the purchase, lease, or order of any good, facility, item, or service reimbursable, in whole or in part, under a federal healthcare program; and the federal false claims laws, including, without limitation the federal civil False Claims Act, prohibit, among other things, anyone from knowingly and willingly presenting, or causing to be presented for payment, to the federal government (including Medicare and Medicaid) claims for reimbursement for, among other things, drugs or services that are false or fraudulent, claims for items or services not provided as claimed, or claims for medically unnecessary items or services. The ACA, among other things, amended the intent requirement of the federal Anti-Kickback Statute to clarify that 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 crime. In addition, the ACA clarifies that the government may assert that a claim that includes items or service resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the federal civil False Claims Act.



In addition, we may be subject to the Health Insurance Portability and Accountability Act of 1996, or HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act and its implementing regulations, which imposes certain requirements relating to the privacy, security and transmission of individually identifiable health information without appropriate authorization by entities subject to the rule, such as health plans, health care clearinghouses and certain health care providers and their business associates who create, use or disclose HIPAA protected health information on their behalf. We may also be subject to state and foreign laws that govern the privacy and security of health information in some circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

If our operations are found to be in violation of any of these laws, we may be subject to penalties, including, without limitation, civil, criminal, and administrative penalties, damages, fines, disgorgement, the curtailment or restructuring of our operations, exclusion from participation in federal and state healthcare programs, additional integrity oversight and reporting obligations, individual imprisonment, contractual damages, and reputational harm, any of which could adversely affect our ability to operate our business and our results of operations.

### **Risks Related to Intellectual Property**

***If we are unable to protect our intellectual property, it may reduce our ability to maintain any technological or competitive advantage over our competitors and potential competitors, and our business may be harmed.***

We rely on patent protection as well as trademark, copyright, trade secret and other intellectual property rights protection and contractual restrictions to protect our proprietary technologies, all of which provide limited protection and may not adequately protect our rights or permit us to gain or keep any competitive advantage. As of April 13, 2018, we were the assignee or assignee-applicant of 10 granted U.S. patents and approximately 12 pending U.S. patent applications. We also were the assignee-applicant of approximately 79 pending patent applications and granted patents in particular jurisdictions outside the U.S. If we fail to protect and/or maintain our intellectual property, third parties may be able to compete more effectively against us, we may lose our technological or competitive advantage, and/or we may incur substantial litigation costs in our attempts to recover or restrict use of our intellectual property.

We cannot assure investors that any of our currently pending or future patent applications will result in granted patents, and we cannot predict how long it will take for such patents to issue, if at all. It is possible that, for any of our patents that have issued or that may issue in the future, our competitors may design their products around our patented technologies. Further, we cannot assure investors that other parties will not challenge any patents granted to us, or that courts or regulatory agencies will hold our patents to be valid, enforceable, and/or infringed. We cannot guarantee investors that we will be successful in defending challenges made against our patents and patent applications. Any successful third-party challenge or challenges to our patents could result in the unenforceability or invalidity of such patents, or such patents being interpreted narrowly and/or in a manner adverse to our interests. Our ability to establish or maintain a technological or competitive advantage over our competitors and/or market entrants may be diminished because of these uncertainties. For these and other reasons, our intellectual property may not provide us with any competitive advantage. For example:

- we or our licensors might not have been the first to make the inventions claimed or disclosed by our pending patent applications or issued patents;
- we or our licensors might not have been the first to file patent applications for these inventions. To determine the priority of these inventions, we may have to participate in interference proceedings or derivation proceedings declared by the U.S. Patent and Trademark Office, or the USPTO, which could result in substantial cost to us, and could possibly result in a loss or narrowing of patent rights. No assurance can be given that our patent applications or granted patents (or those of our licensors) will have priority over any other patent or patent application involved in such a proceeding, or will be held valid as an outcome of the proceeding;

- other parties may independently develop similar or alternative products and technologies or duplicate any of our products and technologies, which can potentially impact our market share, revenue, and goodwill, regardless of whether intellectual property rights are successfully enforced against these other parties;
- it is possible that our owned or licensed pending patent applications will not result in granted patents, and even if such pending patent applications issue as patents, they may not provide intellectual property protection of commercially viable products or product features, may not provide us with any competitive advantages, or may be challenged and invalidated by third parties, patent offices, and/or the courts;
- we may be unaware of or unfamiliar with prior art and/or interpretations of prior art that could potentially impact the validity or scope of our patents or pending patent applications, or patent applications that we intend to file;
- we take efforts and enter into agreements with employees, consultants, collaborators, and advisors to confirm ownership and chain of title in intellectual property rights. However, an inventorship or ownership dispute could arise that may permit one or more third parties to practice or enforce our intellectual property rights, including possible efforts to enforce rights against us;
- we may elect not to maintain or pursue intellectual property rights that, at some point in time, may be considered relevant to or enforceable against a competitor;
- we may not develop additional proprietary products and technologies that are patentable, or we may develop additional proprietary products and technologies that are not patentable ;
- the patents or other intellectual property rights of others may have an adverse effect on our business; and
- we apply for patents relating to our products and technologies and uses thereof, as we deem appropriate. However, we or our representatives or their agents may fail to apply for patents on important products and technologies in a timely fashion or at all, or we or our representatives or their agents may fail to apply for patents in potentially relevant jurisdictions.

To the extent our intellectual property offers inadequate protection, or is found to be invalid or unenforceable, we would be exposed to a greater risk of direct or indirect competition. If our intellectual property does not provide adequate coverage of our competitors' products, our competitive position could be adversely affected, as could our business.

Software is an important component of at least some of our products and services. To the extent such software is not protected by our patents, our dependence on trade secret protection may not provide adequate protection. In addition, the Supreme Court's ruling *Alice Corporation Pty. Ltd. v. CLS Bank International*, has narrowed the scope of patent protection available for software in certain circumstances.

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

In addition to pursuing patents on our technology, we also rely upon trademarks, trade secrets, copyrights and unfair competition laws, as well as license agreements and other contractual provisions, to protect our intellectual property and other proprietary rights. Despite these measures, any of our intellectual property rights could be challenged, invalidated, circumvented or misappropriated. In addition, we take steps to protect our intellectual property and proprietary technology by entering into confidentiality agreements and intellectual property assignment agreements with our employees, consultants, corporate partners and, when needed, our advisors. Such agreements may not be enforceable or may not provide meaningful protection for our trade secrets

and/or other proprietary information in the event of unauthorized use or disclosure or other breaches of the agreements, and we may not be able to prevent such unauthorized disclosure. Moreover, if a party having an agreement with us has an overlapping or conflicting obligation to a third party, our rights in and to certain intellectual property could be undermined. Monitoring unauthorized and inadvertent disclosure is difficult, and we do not know whether the steps we have taken to prevent such disclosure are, or will be, adequate. If we were to enforce a claim that a third party had illegally obtained and was using our trade secrets, it would be expensive and time consuming, the outcome would be unpredictable, and any remedy may be inadequate. In addition, courts outside the U.S. may be less willing to protect trade secrets.

In addition, competitors could purchase our products and attempt to replicate and/or improve some or all of the competitive advantages we derive from our development efforts, willfully infringe our intellectual property rights, design their products around our protected technology or develop their own competitive technologies that fall outside of our intellectual property rights. If our intellectual property does not adequately protect our market share against competitors' products and methods, our competitive position could be adversely affected, as could our business.

***We have rights in some intellectual property that has been discovered through government funded programs and thus is subject to federal regulations such as "march-in" rights, certain reporting requirements, and a preference for U.S. industry. Compliance with such regulations may limit our exclusive rights, subject us to expenditure of resources with respect to reporting requirements, and limit our ability to contract with non-U.S. manufacturers.***

Some of the intellectual property rights assigned to us and/or in-licensed to us have been generated through the use of U.S. government funding and are therefore subject to certain federal regulations. For example, all of the intellectual property rights licensed to us under our license agreement with Princeton University have been generated using U.S. government funds. As a result, the U.S. government has certain rights to intellectual property embodied in our current or future products pursuant to the Bayh-Dole Act of 1980. These U.S. government rights in certain inventions developed under a government-funded program include a non-exclusive, non-transferable, irrevocable worldwide license to use inventions for any governmental purpose. In addition, the U.S. government has the right to require us to grant exclusive, partially exclusive, or non-exclusive licenses to any of these inventions to a third party if the government determines that: (i) adequate steps have not been taken to commercialize the invention; (ii) government action is necessary to meet public health or safety needs; or (iii) government action is necessary to meet requirements for public use under federal regulations (also referred to as "march-in rights"). The U.S. government also has the right to take title to these inventions if we fail, or the applicable licensor fails, to disclose the invention to the government, elect title, and file an application to register the intellectual property within specified time limits. In addition, the U.S. government may acquire title to these inventions in any country in which a patent application is not filed within specified time limits. Intellectual property generated under a government funded program is also subject to certain reporting requirements, compliance with which may require us, or the applicable licensor, to expend substantial resources. In addition, the U.S. government requires that any products embodying the subject invention or produced through the use of the subject invention be manufactured substantially in the U.S. The manufacturing preference requirement can be waived if the owner of the intellectual property can show that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the U.S. or that, under the circumstances, domestic manufacture is not commercially feasible. This preference for U.S. manufacturing may limit our ability to license the applicable patent rights on an exclusive basis under certain circumstances.

If we enter into future arrangements involving government funding, and we make inventions as a result of such funding, intellectual property rights to such discoveries may be subject to the applicable provisions of the Bayh-Dole Act. To the extent any of our current or future intellectual property is generated through the use of U.S. government funding, the provisions of the Bayh-Dole Act may similarly apply. Any exercise by the government of certain of its rights could harm our competitive position, business, financial condition, results of operations and prospects.

***We depend on technology that is licensed to us by Princeton University. Any loss of our rights to this technology could prevent us from selling our products.***

Some technology that relates to analysis of nucleic acids is licensed exclusively to us from Princeton University, or Princeton. We do not own the patents that underlie this license. Our rights to use this technology and employ the inventions claimed in the licensed patents are subject to the continuation of and compliance with the terms of the license. Our principal obligations under our license agreement with Princeton are as follows:

- royalty payments;
- annual maintenance fees;
- using commercially reasonable efforts to develop and sell a product using the licensed technology and developing a market for such product;
- paying and/or reimbursing fees related to prosecution, maintenance and enforcement of patent rights; and
- providing certain reports.

If we breach any of these obligations, Princeton may have the right to terminate or modify the license, which could result in our being unable to develop, manufacture and sell our products or a competitor gaining access to the relevant technology. Termination or certain modifications of our license agreement with Princeton would have a material adverse effect on our business.

In addition, we are a party to a number of other agreements that include licenses to intellectual property, including non-exclusive licenses. We may need to enter into additional license agreements in the future. Our business could suffer, for example, if any current or future licenses terminate, if the licensors fail to abide by the terms of the license, 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.

As we have done previously, we may need or may choose to obtain licenses and/or acquire intellectual property rights from third parties to advance our research or begin commercialization of our current or future products, and

we cannot provide any assurances that third-party patents do not exist that might be enforced against our current or future products in the absence of such a license. We may fail to obtain any of these licenses or intellectual property rights on commercially reasonable terms. Even if we are able to obtain a license, it may be non-exclusive, thereby giving our competitors access to the same technologies licensed to us. In that event, we may be required to expend significant time and resources to develop or license replacement technology. If we are unable to do so, we may be unable to develop or commercialize the affected products, which could materially harm our business and the third parties owning such intellectual property rights could seek either an injunction prohibiting our sales, or, with respect to our sales, an obligation on our part to pay royalties and/or other forms of compensation.

Licensing of intellectual property is important to our business and involves complex legal, business and scientific issues. Disputes may arise between us and our licensors regarding intellectual property subject to a license agreement, including:

- the scope of rights granted under the license agreement and other interpretation-related issues;
- whether and the extent to which our technology and processes infringe any intellectual property of the licensor that is not subject to the licensing agreement;
- whether to take action to enforce any intellectual property rights against an allegedly infringing product or process of a third party;

- our right to sublicense patent and other rights to third parties;
- our diligence obligations with respect to the use of licensed technology in relation to our development and commercialization of our products, and what activities satisfy those diligence obligations; and
- the ownership of inventions and know-how, such as intellectual property resulting from the joint creation or use of intellectual property by our licensors and us and our partners.

If disputes over intellectual property that we have licensed prevent or impair our ability to maintain our current licensing arrangements on acceptable terms, we may be unable to successfully develop and commercialize the affected product, or the dispute may have an adverse effect on our results of operation.

In addition to agreements pursuant to which we in-license intellectual property, we may in the future grant licenses under our intellectual property, or sell certain intellectual property. Like in-licenses, out-licenses can be complex and disputes may arise between us and our licensees, such as the types of disputes described above. Moreover, licensees may breach their obligations, or we may be exposed to liability due to our failure or alleged failure to satisfy our obligations. Any such occurrence could have an adverse effect on our business.

***If we or any of our partners is sued for infringing intellectual property rights of third parties, it would be costly and time consuming, and an unfavorable outcome in that litigation could have a material adverse effect on our business.***

Our success also depends on our ability to develop, manufacture, market and sell our products and perform our services without infringing the proprietary rights of third parties. Numerous U.S. and foreign-issued patents and pending patent applications owned by third parties exist in the fields in which we are developing products and services. As part of a business strategy to impede our successful commercialization and entry into new markets, competitors may allege that our products and/or services infringe their intellectual property rights.

We could incur substantial costs and divert the attention of our management and technical personnel in defending ourselves against claims of infringement made by third parties. Any adverse ruling by a court or administrative body, or perception of an adverse ruling, may have a material adverse impact on our ability to conduct our business and our finances. Moreover, third parties making claims against us may be able to obtain injunctive relief against us, which could block our ability to offer one or more products or services and could result in a substantial award of damages against us. In addition, since we sometimes indemnify customers, collaborators or licensees, we may have additional liability in connection with any infringement or alleged infringement of third party intellectual property. Intellectual property litigation can be very expensive, and we may not have the financial means to defend ourselves or our customers, collaborators and licensees.

Because patent applications can take many years to issue, there may be pending applications, some of which are unknown to us, that may result in issued patents upon which our products or proprietary technologies may infringe. Moreover, we may fail to identify issued patents of relevance or incorrectly conclude that an issued patent is invalid or not infringed by our technology or any of our products. There is a substantial amount of litigation involving patents and other intellectual property rights in our industry. If a third-party claims that we or any of our licensors, customers or collaboration partners infringe upon a third-party's intellectual property rights, we may have to:

- seek to obtain licenses that may not be available on commercially reasonable terms, if at all;
- abandon any product alleged or held to infringe, or redesign our products or processes to avoid potential assertion of infringement;
- pay substantial damages including, in exceptional cases, treble damages and attorneys' fees, which we may have to pay if a court decides that the product or proprietary technology at issue infringes upon or violates the third-party's rights;

- pay substantial royalties or fees or grant cross-licenses to our technology; or
- defend litigation or administrative proceedings that may be costly whether we win or lose, and which could result in a substantial diversion of our financial and management resources.

***We may be involved in lawsuits to protect or enforce our patents or the patents of our licensors, which could be expensive, time-consuming and unsuccessful.***

Competitors may infringe our patents or the patents we license in. In the event of infringement or unauthorized use, we may file one or more infringement lawsuits, which can be expensive and time-consuming. An adverse result in any such litigation proceedings could put one or more of our patents at risk of being invalidated, being found to be unenforceable, and/or being interpreted narrowly and could put our patent applications at risk of not issuing and/or could impact the validity or enforceability positions of our other patents or those we license. 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.

Most of our competitors are larger than we are and have substantially greater resources. They are, therefore, likely to be able to sustain the costs of complex patent litigation longer than we could. In addition, the uncertainties associated with litigation could have a material adverse effect on our ability to raise the funds necessary to continue our operations, continue our internal research programs, in-license needed technology, pursue, obtain or maintain intellectual property rights, or enter into development partnerships that would help us bring our products to market.

In addition, patent litigation can be very costly and time-consuming. An adverse outcome in such litigation or proceedings may expose us or any of our future development partners to loss of our proprietary position, expose us to significant liabilities, or require us to seek licenses that may not be available on commercially acceptable terms, if at all.

***Our issued patents could be found invalid or unenforceable if challenged in court or at the Patent Office or other administrative agency, which could have a material adverse impact on our business.***

If we or any of our partners were to initiate legal proceedings against a third party to enforce a patent related to one of our products or services, the defendant in such litigation could counterclaim that our patent is invalid and/or unenforceable. In patent litigation in the U.S., defendant counterclaims alleging invalidity and/or unenforceability are commonplace, as are validity challenges by the defendant against the subject patent or other patents before the USPTO. 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, failure to meet the written description requirement, indefiniteness, and/or failure to disclose the best mode or to claim patent eligible subject matter. Grounds for an unenforceability assertion could be an allegation that someone connected with prosecution of the patent intentionally withheld material information from the USPTO, or made a misleading statement, during prosecution. Additional grounds for an unenforceability assertion include an allegation of misuse or anticompetitive use of patent rights, and an allegation of incorrect inventorship with deceptive intent. Third parties may also raise similar claims before the USPTO even outside the context of litigation. The outcome is unpredictable following legal assertions of invalidity and unenforceability. With respect to the validity question, for example, we cannot be certain that no invalidating prior art existed of which we and the patent examiner were unaware during prosecution. These assertions may also be based on information known to us or the Patent Office. If a defendant or third party were to prevail on a legal assertion of invalidity and/or unenforceability, we would lose at least part, and perhaps all, of the claims of the challenged patent. Such a loss of patent protection would or could have a material adverse impact on our business.

***We may be subject to claims that our employees, consultants or independent contractors have wrongfully used or disclosed alleged trade secrets of their other clients or former employers to us, and/or that their other clients or former employers allegedly have rights in our intellectual property, which could subject us to costly litigation.***

As is common in the life sciences industry, we engage the services of consultants and independent contractors to assist us in the development of our products. Many of these consultants and independent contractors were previously employed at, or may have previously or may be currently providing consulting or other services to, universities or other technology, biotechnology or pharmaceutical companies, including our competitors or potential competitors. We may become subject to claims that our company, a consultant or an independent contractor inadvertently or otherwise used or disclosed trade secrets or other information proprietary to their former employers or their former or current clients. We may similarly be subject to claims stemming from similar actions of an employee, such as one who was previously employed by another company, including a competitor or potential competitor. We may become subject to claims that one or more current or former employees, consultants, advisors, or independent contractors of ours owns rights in our intellectual property and/or has assigned or is under an obligation to assign rights in our intellectual property to another party. This may include a competitor of ours. If a competitor has rights in our patents, the competitor or a licensee or related entity may be able to make, use, sell, import, and/or export the patented technology without liability to us under our patents or the patents we license. Litigation may be necessary to defend against these claims. Even if we are successful in defending against these claims, litigation could result in substantial costs and be a distraction to our management team. If we were not successful we could lose valuable intellectual property rights.

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

We generally enter into confidentiality and intellectual property assignment agreements with our employees, consultants, and contractors. These agreements generally provide that inventions conceived by the party in the course of rendering services to us will be our exclusive property. However, those agreements may not be honored and may not effectively assign or may be alleged to ineffectively assign intellectual property rights to us. For example, even if we have a consulting agreement in place with an academic advisor pursuant to which such academic advisor is required to assign any inventions developed in connection with providing services to us, such academic advisor may not have the right to assign such inventions to us, as it may conflict with his or her obligations to assign all such intellectual property to his or her employing institution.

In addition, we sometimes enter into agreements where we provide services to third parties, such as customers. Under such circumstances, our agreements may provide that certain intellectual property that we conceive in the course of providing those services is assigned to the customer. In those cases, we may not be able to use that particular intellectual property in, for example, our work for other customers without a license.

***We may not be able to protect our intellectual property rights throughout the world, which could materially and negatively affect our business.***

Filing, prosecuting, maintaining, and defending patents on current and future products in all countries throughout the world would be prohibitively expensive, and our intellectual property rights in some countries outside the U.S. can be less extensive than those in the U.S. In addition, the laws of some foreign countries do not protect intellectual property rights to the same extent as federal and state laws in the U.S. Consequently, regardless of whether we are able to prevent third parties from practicing our inventions in the U.S., we may not be able to prevent third parties from practicing our inventions in all countries outside the U.S., or from selling or importing products made using our inventions in and into the U.S. or other jurisdictions. Competitors may use our technologies in jurisdictions where we have not pursued and obtained patent protection to develop their own products, and further, may export otherwise infringing products to territories where we have patent protection, but enforcement is not as strong as it is in the U.S. 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. Even if we pursue and obtain issued patents in particular jurisdictions, our patent claims or other intellectual property rights may not be effective or sufficient to prevent third parties from so competing. 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.

Many companies have encountered significant problems in protecting and defending intellectual property rights in foreign jurisdictions. The legal systems of certain countries, particularly certain developing countries, do not favor the enforcement of patents and other intellectual property protection, particularly those relating to biotechnology, which could make it difficult for us to stop the infringement of our patents or marketing of competing products in violation of our proprietary rights generally. 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, could put our patents at risk of being invalidated or interpreted narrowly and our patent applications at risk of not issuing, and could provoke third parties to assert claims against us. We may not prevail in any lawsuits that we initiate and the damages or other remedies awarded, if any, may not be commercially meaningful. Accordingly, our efforts to enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or license and may adversely impact our business.

In addition, we and our partners also face the risk that our products or components thereof are imported, reimported, or exported into markets with relatively higher prices from markets with relatively lower prices, which would result in a decrease of sales and any payments we receive from the affected market. Recent developments in U.S. patent law have made it more difficult to stop these and related practices based on theories of patent infringement.

***Changes in patent laws or patent jurisprudence could diminish the value of patents in general, thereby impairing our ability to protect our products.***

As is the case with other life science industry companies, our success is heavily dependent on intellectual property, particularly patents. Obtaining and enforcing patents involve both technological complexity and legal complexity. Therefore, obtaining and enforcing patents is costly, time-consuming and inherently uncertain. In addition, the America Invents Act, or the AIA, became effective on March 16, 2013.

An important change introduced by the AIA is that the U.S. transitioned to a “first-to-file” system for deciding which party should be granted a patent when two or more patent applications are filed by different parties claiming the same invention. A third party that files a patent application in the USPTO after that date but before us could therefore be awarded a patent claiming or disclosing an invention of ours even if we had made the invention before it was made by the third party. This will require us to be cognizant going forward of the time from invention to filing of a patent application, but circumstances could prevent us from promptly filing patent applications on our inventions. Additionally, there can be a trade-off between obtaining an earlier filing date, and waiting to obtain additional data and/or further refine a patent application. In some circumstances, the effects of a decision to pursue an earlier filing or a later filing will not be known until prior art or third party activities are subsequently discovered, such as by the USPTO or by a third party seeking to challenge patent rights. These circumstances may apply, for example, to patent applications prepared and filed around the time of the implementation of the AIA, or with a priority application that preceded the implementation of the AIA.

Among some of the other changes introduced by the AIA are changes that limit where a patent holder may file a patent infringement suit and providing additional opportunities for third parties to challenge an issued patent in the USPTO. This applies to all of our owned and in-licensed U.S. patents, even those issued before March 16, 2013. Because of a lower standard for evidence in USPTO proceedings compared to the standard for evidence in U.S. 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 court action. Accordingly, a third party may try to use the USPTO procedures to invalidate our patent claims that would not have been invalidated if first challenged by the third party in court. 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. In addition, the contours of the laws under the AIA are subject to further judicial interpretation and/or legislative changes.

Additionally, the U.S. Supreme Court has ruled on several patent cases in recent years, such as *Impression Products, Inc. v. Lexmark International, Inc.*, *Association for Molecular Pathology v. Myriad Genetics, Inc.*, *Mayo Collaborative Services v. Prometheus Laboratories, Inc.* and *Alice Corporation Pty. Ltd. v. CLS Bank International*, either narrowing the scope of patent protection available in certain circumstances or weakening the rights of patent owners in certain situations. In addition to increasing uncertainty with our ability to obtain patents in the future, this combination of events has created uncertainty as to the value of patents, once obtained, including patents in the molecular biology analysis and diagnostic space in particular. Depending on decisions by the U.S. Congress, the federal courts, and the USPTO, the laws and regulations governing patents could change in unpredictable ways that could weaken our ability to obtain new patents or to enforce our existing patents and patents that we might obtain in the future.

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

The USPTO and various foreign governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other provisions during the patent process. There are situations in which noncompliance can result in abandonment or lapse of a patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. In such an event, competitors might be able to enter the market earlier than would otherwise have been the case. In some cases, our licensors may be responsible for these payments, thereby decreasing our control over compliance with these requirements.

***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 registered or unregistered trademarks or trade names may be challenged, infringed, circumvented or declared generic or determined to be infringing other marks. We may not be able to protect our rights to these trademarks and trade names, which we need to build name recognition by potential partners or customers in our markets of interest. At times, competitors may adopt trade names or trademarks similar to ours, thereby impeding our ability to build brand identity and possibly leading to market confusion. In addition, there could be potential trade name or trademark infringement claims brought by owners of other registered trademarks. Over the long term, if we are unable to establish name recognition based on our trademarks and trade names, then we may not be able to compete effectively and our business may be adversely affected.

***We may use third-party open source software components in future products, and failure to comply with the terms of the underlying open source software licenses could restrict our ability to sell such products.***

While our current products do not contain any software tools licensed by third-party authors under “open source” licenses, we may choose to use open source software in future products. Use and distribution of open source software may entail greater risks than use of third-party commercial software, as open source licensors generally do not provide warranties or other contractual protections regarding infringement claims or the quality of the code. Some open source licenses may contain requirements that we make available source code for modifications or derivative works we create based upon the type of open source software we use. If we combine our proprietary software with open source software in a certain manner, we could, under certain open source

licenses, be required to release the source code of our proprietary software to the public. This would allow our competitors to create similar products with less development effort and time, and ultimately could result in a loss of product sales.

Although we intend to monitor any use of open source software to avoid subjecting our products to conditions we do not intend, the terms of many open source licenses have not been interpreted by U.S. courts, and there is a risk that any such licenses could be construed in a way that could impose unanticipated conditions or restrictions on our ability to commercialize our products. Moreover, we cannot assure investors that our processes for controlling our use of open source software in our products will be effective. If we are held to have breached the terms of an open source software license, we could be required to seek licenses from third parties to continue offering our products on terms that are not economically feasible, to re-engineer our products, to discontinue the sale of our products if re-engineering could not be accomplished on a timely basis, or to make generally available, in source code form, our proprietary code, any of which could adversely affect our business, operating results, and financial condition.

***We use third-party software that may be difficult to replace or cause errors or failures of our products that could lead to lost customers or harm to our reputation.***

We use software licensed from third parties in our products. In the future, this software may not be available to us on commercially reasonable terms, or at all. Any loss of the right to use any of this software could result in delays in the production of our products until equivalent technology is either developed by us, or, if available, is identified, obtained and integrated, which could harm our business. In addition, any errors or defects in third-party software or other third-party software failures could result in errors or defects or cause our products to fail, which could harm our business and be costly to correct. Many of these providers attempt to impose limitations on their liability for such errors, defects or failures, and, if enforceable, we may have additional liability to our customers or third-party providers that could harm our reputation and increase our operating costs.

We intend to maintain our relationships with third-party software providers and to seek software from such providers that does not contain any errors or defects. Any failure to do so could adversely impact our ability to deliver reliable products to our customers and could harm our results of operations.

***Numerous factors may limit any potential competitive advantage provided by our intellectual property rights.***

The degree of future protection afforded by our intellectual property rights is uncertain because intellectual property rights have limitations, and may not adequately protect our business, provide a barrier to entry against our competitors or potential competitors, or permit us to maintain our competitive advantage. Moreover, if a third party has intellectual property rights that cover or impact our use of our technology, we may not be able to fully use or extract value from our intellectual property rights. For example:

- others may be able to develop and/or use technology that is similar to our technology or aspects of our technology but that does not cover the claims of any our patents or patents that may issue from our patent applications or those we license;
- we or the licensor of our licensed-in patents might not have been the first to make the inventions disclosed and/or claimed in a pending patent application that we own or license;
- we or the licensor of our licensed-in patents might not have been the first to file patent applications disclosing and/or claiming an invention;
- others may independently develop similar or alternative technologies without infringing our or our licensors' intellectual property rights;
- pending patent applications that we own or license may not lead to issued patents or may not result in the claims that we want (for example, as to the scope of issued claims, if any);

- patents, if issued, that we own or license may not provide us with any competitive advantages, or may be held invalid or unenforceable, as a result of legal challenges by our competitors or other third parties;
- third parties may compete with us in jurisdictions where we do not pursue and obtain patent protection;
- we may not be able to obtain and/or maintain necessary or useful licenses on reasonable terms or at all;
- third parties may assert an ownership interest in our intellectual property and, if successful, such disputes may preclude us from exercising exclusive rights over that intellectual property;
- we may not be able to maintain the confidentiality of our trade secrets or other proprietary information;
- we may not develop or in-license additional proprietary technologies that are patentable; and
- the patents or other intellectual property of others may have an adverse effect on our business.

Should any of these events occur, they could significantly harm our business and results of operations.

#### **Risks Related to This Offering and Ownership of our Securities**

***We do not know whether an active, liquid and orderly trading market will develop for our securities or what the market price of our securities will be and as a result it may be difficult for you to sell our securities.***

Prior to this offering there has been no public market for our securities. Although our securities have been approved for listing on The Nasdaq Stock Market LLC, or Nasdaq, an active trading market for our securities may never develop or be sustained following this offering. You may not be able to sell your securities quickly or at the market price if trading in our securities is not active. The initial public offering price for our securities will be determined through negotiations with the underwriters, and the negotiated price may not be indicative of the market price of the securities after the offering. As a result of these and other factors, you may be unable to resell our securities at or above the initial public offering price. Further, an inactive market may also impair our ability to raise capital by selling our securities and may impair our ability to enter into strategic partnerships or acquire companies or products by using our securities as consideration.

***The price of our securities may be volatile, and you could lose all or part of your investment.***

The trading price of our securities following this offering is likely to be highly volatile and could be subject to wide fluctuations in response to various factors, some of which are beyond our control, including limited trading volume. In addition to the factors discussed in this “Risk Factors” section and elsewhere in this prospectus, these factors include:

- our commercial progress in marketing and selling our systems, including sales and revenue trends;
- changes in laws or regulations applicable our systems;
- adverse developments related to our laboratory facilities;
- increased competition in the diagnostics services industry;
- the failure to obtain and/or maintain adequate reimbursement of our systems;
- adverse developments concerning our manufacturers and suppliers;
- our inability to establish future collaborations;
- additions or departures of key scientific or management personnel;
- introduction of new testing services offered by us or our competitors;

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- announcements of significant acquisitions, strategic partnerships, joint ventures or capital commitments by us or our competitors;
- our ability to effectively manage our growth;
- the size and growth, if any, of our targeted markets;
- actual or anticipated variations in quarterly operating results;
- our cash position;
- our failure to meet the estimates and projections of the investment community or that we may otherwise provide to the public;
- publication of research reports about us or our industry or positive or negative recommendations or withdrawal of research coverage by securities analysts;
- changes in the market valuations of similar companies;
- overall performance of the equity markets;
- issuances of debt or equity securities;
- sales of our securities by us or our stockholders in the future;
- trading volume of our securities;
- changes in accounting practices;
- ineffectiveness of our internal controls;
- disputes or other developments relating to proprietary rights, including our ability to adequately protect our technologies;
- significant lawsuits, including patent or stockholder litigation;
- general political and economic conditions; and
- other events or factors, many of which are beyond our control.

In addition, the stock market in general, and diagnostic and biotechnology companies in particular, have experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of these companies. Broad market and industry factors may negatively affect the market price of our securities, regardless of our actual operating performance. If the market price of our securities after this offering does not exceed the initial public offering price, you may not realize any return on your investment in us and may lose some or all of your investment. In the past, securities class action litigation has often been instituted against companies following periods of volatility in the market price of a company's securities. This type of litigation, if instituted, could result in substantial costs and a diversion of management's attention and resources, which would harm our business, operating results or financial condition.

***We have never paid dividends and we do not intend to pay dividends on our capital stock, so any returns on your investment in our securities will be limited to appreciation in the value of our securities.***

We have never declared or paid any cash dividend on our capital stock. We currently anticipate that we will retain future earnings for the development, operation and expansion of our business and do not anticipate declaring or paying any cash dividends for the foreseeable future. Any determination to pay dividends in the future will be at the discretion of our board of directors and will depend upon results of operations, financial condition, contractual restrictions, restrictions imposed by applicable law and other factors our board of directors deems relevant. Accordingly, if you purchase securities in this offering, realization of a gain on your investment will depend on the appreciation of the price of our securities, which may never occur. In addition, our loan and security agreement with Midcap contains a negative covenant which prohibits us from paying dividends without the prior written consent of Midcap.

***Our principal stockholders and management own a significant percentage of our stock and will be able to exert significant control over matters subject to stockholder approval.***

Our executive officers, directors, 5% stockholders and their affiliates held approximately 84.1% of our voting stock as of June 30, 2018, and, upon the closing of this offering, that same group will hold approximately 48.5% of our outstanding voting stock (assuming no exercise of the underwriters' over-allotment option), based upon the number of shares of our common stock outstanding as of June 30, 2018. Therefore, even after this offering, these stockholders will have the ability to influence us through this ownership position. These stockholders may be able to determine all matters requiring stockholder approval. For example, these stockholders may be able to control elections of directors, amendments of our organizational documents, or approval of any merger, sale of assets or other major corporate transaction. This may prevent or discourage unsolicited acquisition proposals or offers for our securities that you may feel are in your best interest as one of our stockholders.

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

The initial public offering price of our units will be substantially higher than the pro forma net tangible book value per share of our common stock forming part of the unit. Therefore, if you purchase units in this offering at the initial public offering price of \$6.125 per unit, you will experience immediate dilution of \$4.13 per unit, the difference between the price per unit you pay for our units and the pro forma net tangible book value per share forming part of the unit as of June 30, 2018, after giving effect to the issuance of units in this offering. This dilution is due in large part to the fact that our earlier investors paid substantially less than the initial public offering price when they purchased their securities.

In addition, we have issued options and warrants to acquire our capital stock at prices significantly below the initial public offering price. To the extent outstanding options and warrants are ultimately exercised, there will be further dilution to investors purchasing our securities in this offering. In addition, if the underwriters exercise their option to purchase additional units from us or if we issue additional equity securities, you will experience additional dilution.

***We are an emerging growth company, and the reduced reporting requirements applicable to emerging growth companies could make our securities less attractive to investors.***

We are an emerging growth company, as defined in the Jumpstart Our Business Startups Act of 2012, or the JOBS Act. For as long as we continue to be an emerging growth company, we may take advantage of exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies, including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, or the Sarbanes-Oxley Act, reduced disclosure obligations regarding executive compensation in this prospectus and our periodic reports and proxy statements and exemptions from the requirements of holding nonbinding 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 year in which we complete this offering, although circumstances could cause us to lose that status earlier, including if the market value of our common stock held by non-affiliates exceeds \$700.0 million as of any June 30 before that time or if we have total annual gross revenue of \$1.07 billion or more during any fiscal year before that time, in which cases we would no longer be an emerging growth company as of the following December 31 or, if we issue more than \$1.0 billion in non-convertible debt during any three year period before that time, we would cease to be an emerging growth company immediately. Even after we no longer qualify as an emerging growth company, we may still qualify as a "smaller reporting company" which would allow us to take advantage of many of the same exemptions from disclosure requirements including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act and reduced disclosure obligations regarding executive compensation in our periodic reports and proxy statements. We cannot predict if

investors will find our securities less attractive because we may rely on these exemptions, which could result in a less active trading market for our securities and increased volatility in the price of our securities.

Under the JOBS Act, emerging growth companies can also delay adopting new or revised accounting standards that have different effective dates for public and private companies until those standards apply to private companies. We have elected to use this extended transition period. As a result of this election, our timeline to comply with these standards will in many cases be delayed as compared to other public companies that are not eligible to take advantage of this election or have not made this election. Therefore, our financial statements may not be comparable to those of companies that comply with the public company effective dates for these standards.

In addition, if we cease to be an emerging growth company, we will no longer be able to use the extended transition period for complying with new or revised accounting standards. As a result, changes in rules of U.S. generally accepted accounting principles or their interpretation, the adoption of new guidance or the application of existing guidance to changes in our business could significantly affect our financial position and results of operations.

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

After the closing of this offering, we will be subject to the reporting requirements of the Securities Exchange Act of 1934, as amended, the Sarbanes-Oxley Act and the rules and regulations of Nasdaq. The Sarbanes-Oxley Act requires, among other things, that we maintain effective disclosure controls and procedures and internal controls over financial reporting. Internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements in accordance with accounting principles generally accepted in the U.S.. Commencing with our fiscal year ending December 31, 2018, we must perform system and process evaluation and testing of our internal controls over financial reporting to allow management to report on the effectiveness of our internal controls over financial reporting in our Form 10-K filing for that year, as required by Section 404 of the Sarbanes-Oxley Act. This will require that we incur substantial additional professional fees and internal costs to expand our accounting and finance functions and that we expend significant management efforts. Prior to this offering, we have never been required to test our internal controls within a specified period, and, as a result, we may experience difficulty in meeting these reporting requirements in a timely manner.

During the evaluation and testing process of our internal controls, if we identify one or more material weaknesses in our internal control over financial reporting, we will be unable to assert that our internal control over financial reporting is effective. We cannot assure you that there will not be material weaknesses or significant deficiencies in our internal control over financial reporting in the future. Any failure to maintain internal control over financial reporting could severely inhibit our ability to accurately report our financial condition or results of operations. If we are unable to conclude that our internal control over financial reporting is effective, or if our independent registered public accounting firm determines we have a material weakness or significant deficiency in our internal control over financial reporting, we could lose investor confidence in the accuracy and completeness of our financial reports, the market price of our securities could decline, and we could be subject to sanctions or investigations by Nasdaq, the Securities and Exchange Commission, or the SEC, or other regulatory authorities. Failure to remedy any material weakness in our internal control over financial reporting, or to implement or maintain other effective control systems required of public companies, could also restrict our future access to the capital markets.

***We will incur significant increased costs as a result of operating as a public company, and our management will be required to devote substantial time to new compliance initiatives.***

As a public company, we will incur significant legal, accounting and other expenses that we did not incur as a private company. We will be subject to the reporting requirements of the Securities Exchange Act of 1934, as

amended, which will require, among other things, that we file with the SEC annual, quarterly and current reports with respect to our business and financial condition. In addition, the Sarbanes-Oxley Act, as well as rules subsequently adopted by the SEC and Nasdaq to implement provisions of the Sarbanes-Oxley Act, impose significant requirements on public companies, including requiring establishment and maintenance of effective disclosure and financial controls and changes in corporate governance practices. Further, in July 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act, or the Dodd-Frank Act, was enacted. There are significant corporate governance and executive-compensation-related provisions in the Dodd-Frank Act that require the SEC to adopt additional rules and regulations in these areas. Recent legislation permits emerging growth companies to implement many of these requirements over a longer period and up to five years from the pricing of this offering. We intend to take advantage of this new legislation, but cannot assure you that we will not be required to implement these requirements sooner than planned and thereby incur unexpected expenses. Stockholder activism, the current political environment and the current high level of government intervention and regulatory reform may lead to substantial new regulations and disclosure obligations, which may lead to additional compliance costs and impact the manner in which we operate our business in ways we cannot currently anticipate.

We expect the rules and regulations applicable to public companies to substantially increase our legal and financial compliance costs and to make some activities more time-consuming and costly. If these requirements divert the attention of our management and personnel from other business concerns, they could have a material adverse effect on our business, financial condition and results of operations. The increased costs will decrease our net income or increase our consolidated net loss, and may require us to reduce costs in other areas of our business or increase the prices of our products or services. For example, we expect these rules and regulations to make it more difficult and more expensive for us to obtain director and officer liability insurance and we may be required to incur substantial costs to maintain the same or similar coverage. We cannot predict or estimate the amount or timing of additional costs we may incur to respond to these requirements. The impact of these requirements could also make it more difficult for us to attract and retain qualified persons to serve on our board of directors, our board committees or as executive officers.

***Sales of a substantial number of shares of our common stock by our existing stockholders in the public market could cause our stock price to fall.***

If our existing stockholders sell, or indicate an intention to sell, substantial amounts of our common stock in the public market after the lock-up and other legal restrictions on resale discussed in this prospectus lapse, the trading price of our securities could decline. Based on shares of common stock outstanding as of June 30, 2018, upon the closing of this offering we will have outstanding a total of 9,491,432 shares of common stock (including shares of common stock included in the units but excluding shares underlying the warrants included in the units). Of these shares, only the shares of common stock forming part of the unit sold in this offering by us, plus any shares of common stock forming part of the unit sold upon exercise of the underwriters' over-allotment option, will be freely tradable without restriction in the public market immediately following this offering (except for any shares purchased by our affiliates). Roth Capital Partners, however, may, in its discretion, permit our officers, directors and other stockholders who are subject to these lock-up agreements to sell shares prior to the expiration of the lock-up agreements.

We expect that the lock-up agreements pertaining to this offering will expire 180 days from the date of this prospectus. After the lock-up agreements expire, up to an additional 6,131,432 shares of common stock will be eligible for sale in the public market, though such shares held by directors, executive officers and other affiliates and may be subject to volume limitations under Rule 144 under the Securities Act. In addition, shares of common stock that are either subject to outstanding options or reserved for future issuance under our employee benefit 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 and Rule 144 and Rule 701 under the Securities Act. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the trading price of our securities could decline.

After this offering, the holders of 3,930,573 shares of our common stock will be entitled to rights with respect to the registration of their shares under the Securities Act, subject to the lock-up agreements described above. See “Description of Securities—Registration Rights.” Registration of these shares under the Securities Act would result in the shares becoming freely tradable without restriction under the Securities Act. Any sales of securities by these stockholders could have a material adverse effect on the trading price of our securities.

***Future sales and issuances of our securities or rights to purchase securities, including pursuant to our equity incentive plans, could result in additional dilution to our stockholders and could cause our stock price to fall.***

Sales of a substantial number of securities in the public market following the completion of this offering, or the perception that these sales might occur, could depress the market price of our securities and could impair our ability to raise capital through the sale of additional equity securities. We are unable to predict the effect that such sales may have on the prevailing market price of our securities.

All of our executive officers, senior management and directors and all of the holders of our capital stock are subject to lock-up agreements that restrict their ability to transfer shares of our capital stock for 180 days from the date of this prospectus. Subject to certain exceptions, the lock-up agreements limit the number of shares of capital stock that may be sold immediately following this initial public offering. We expect that the lock-up agreements pertaining to this offering will expire 180 days from the date of this prospectus. After the lock-up agreements expire, up to an additional 6,131,432 shares of common stock will be eligible for sale in the public market, of which 3,930,573 shares are held by directors, executive officers and other affiliates and will be subject to volume limitations under Rule 144 under the Securities Act of 1933, as amended, or the Securities Act. In addition, shares of common stock that are either subject to outstanding options or reserved for future issuance under our employee benefit 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 and Rule 144 and Rule 701 under the Securities Act. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the trading price of our securities could decline. The underwriters of this offering may, in their sole discretion, permit our stockholders who are subject to these lock-up agreements to sell shares of common stock prior to the expiration of the lock-up agreements.

***We have broad discretion in the use of the net proceeds from this offering and may not use them effectively.***

Our management will have broad discretion in the application of the net proceeds from this offering, including for any of the purposes described in the section entitled “Use of Proceeds,” and you will not have the opportunity as part of your investment decision to assess whether the net proceeds will be used appropriately. Because of the number and variability of factors that will determine our use of the net proceeds from this offering, their ultimate use may vary substantially from their currently intended use. Our management might not apply our net proceeds in ways that ultimately increase the value of your investment. We intend to use the net proceeds from this offering to expand our commercial capabilities in selling and marketing related to our products, to fund our ongoing research and development activities, and for general corporate purposes, including working capital, operating expenses and capital expenditures.

Our expected use of net proceeds from this offering represents our current intentions based upon our present plans and business condition. As of the date of this prospectus, we cannot predict with certainty all of the particular uses for the net proceeds to be received upon the completion of this offering, or the amounts that we will actually spend on the uses set forth above. The amounts and timing of our actual use of the net proceeds will vary depending on numerous factors, including the commercial success of our systems and the costs of our research and development activities, as well as the amount of cash used in our operations. The costs and timing of research and development activities and the build out of our commercial selling and marketing capabilities, particularly as related to expansion of our systems, are highly uncertain, subject to substantial risks and can often change. Depending on the outcome of these activities, our plans and priorities may change, and we may apply the net proceeds from this offering differently than we currently anticipate. For example, in the event we identify



other opportunities that we believe are in the best interests of our stockholders, we may use a portion of the net proceeds from this offering for the acquisition of, or investment in, technologies, products or companies that complement our business, although we have no current intentions, commitments or agreements to do so. As a result, our management will have broad discretion in the application of the net proceeds, and investors will be relying on our judgment regarding the application of the net proceeds of this offering. In addition, we might decide to postpone or not pursue expansion of our systems if the net proceeds from this offering and other sources of cash are less than expected.

The failure by our management to apply these funds effectively could harm our business. Pending their use, we may invest the net proceeds from this offering in short-term, investment-grade, interest-bearing securities. These investments may not yield a favorable return to our stockholders. If we do not invest or apply the net proceeds from this offering in ways that enhance stockholder value, we may fail to achieve expected financial results, which could cause our stock price to decline.

***Anti-takeover provisions under our charter documents and Delaware law could delay or prevent a change of control which could limit the market price of our securities and may prevent or frustrate attempts by our securityholders to replace or remove our current management.***

Our amended and restated certificate of incorporation and amended and restated bylaws, which are to become effective immediately prior to the closing of this offering, contain provisions that could delay or prevent a change of control of our company or changes in our board of directors that our stockholders might consider favorable. Some of these provisions include:

- a board of directors divided into three classes serving staggered three-year terms, such that not all members of the board will be elected at one time;
- a prohibition on stockholder action through written consent, which requires that all stockholder actions be taken at a meeting of our stockholders;
- a requirement that special meetings of stockholders be called only by the chairman of the board of directors, the chief executive officer, the president or by a majority of the total number of authorized directors;
- advance notice requirements for stockholder proposals and nominations for election to our board of directors;
- a requirement 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 all outstanding shares of our voting stock then entitled to vote in the election of directors;
- a requirement of approval of not less than two-thirds of all outstanding shares of our voting stock to amend any bylaws by stockholder action or to amend specific provisions of our certificate of incorporation; and
- the authority of the board of directors to issue preferred stock on terms determined by the board of directors without stockholder approval and which preferred stock may include rights superior to the rights of the holders of common stock.

In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporate Law, which may prohibit certain business combinations with stockholders owning 15% or more of our outstanding voting stock. These anti-takeover provisions and other provisions in our amended and restated certificate of incorporation and amended and restated bylaws could make it more difficult for stockholders or potential acquirers to obtain control of our board of directors or initiate actions that are opposed by the then-current board of directors and could also delay or impede a merger, tender offer or proxy contest involving our company. These provisions could also discourage proxy contests and make it more difficult

for you and other stockholders to elect directors of your choosing or cause us to take other corporate actions you desire. Any delay or prevention of a change of control transaction or changes in our board of directors could cause the market price of our securities to decline.

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

The trading market for our securities will depend in part on the research and reports that securities or industry analysts publish about us or our business. Securities and industry analysts do not currently, and may never, publish research on our company. If no securities or industry analysts commence coverage of our company, the trading price for our securities would likely be negatively impacted. In the event securities or industry analysts initiate coverage, if one or more of the analysts who covers us downgrades our securities or publishes inaccurate or unfavorable research about our business, the price of our securities may decline. If one or more of these analysts ceases coverage of our company or fails to publish reports on us regularly, demand for our securities could decrease, which might cause the price of our securities and trading volume to decline.

***Our recurring losses and negative cash flows have raised substantial doubt regarding our ability to continue as a going concern.***

Since inception, we have experienced recurring operating losses and negative cash flows, and we expect to continue to generate operating losses and consume significant cash resources for the foreseeable future. Without additional financing, these conditions raise substantial doubt about our ability to continue as a going concern, meaning that we may be unable to continue operations for the foreseeable future or realize assets and discharge liabilities in the ordinary course of operations. As a result, our financial statements include an explanatory paragraph expressing substantial doubt about our ability to continue as a going concern. If we are unable to obtain sufficient funding, our business, prospects, financial condition and results of operations will be materially and adversely affected and we may be unable to continue as a going concern. If we are unable to continue as a going concern, we may have to liquidate our assets and may receive less than the value at which those assets are carried on our consolidated financial statements, and it is likely that investors will lose all or a part of their investment. Future reports from our independent registered public accounting firm may also contain statements expressing doubt about our ability to continue as a going concern. If we seek additional financing to fund our business activities in the future and there remains doubt about our ability to continue as a going concern, investors or other financing sources may be unwilling to provide additional funding on commercially reasonable terms or at all.

***Our amended and restated certificate of incorporation to be effective in connection with the closing of this offering will provide that the Court of Chancery of the State of Delaware or the U.S. federal district courts 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 other employees.***

Our amended and restated certificate of incorporation to be effective in connection with the closing of this offering provides that the Court of Chancery of the State of Delaware is the sole and exclusive forum for any derivative action or proceeding brought on our behalf, any action asserting a breach of fiduciary duty, 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, or any action asserting a claim against us that is governed by the internal affairs doctrine. Our amended and restated certificate of incorporation further provides that the U.S. federal district courts will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act. These choice of 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 such lawsuits. If a court were to find either choice of forum provision contained in our amended and restated certificate of incorporation to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions, which could adversely affect our results of operations and financial condition.

## 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 or financial condition, business strategy and plans, and objectives of management for future operations, 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.

We have based these forward-looking statements largely on our current expectations and projections about future events and financial trends that we believe may affect our financial condition, results of operations, business strategy and financial needs. These forward-looking statements are subject to known and unknown risks, uncertainties and assumptions, including risks described in “Risk Factors” and elsewhere in this prospectus, regarding, among other things:

- the size and growth potential of the markets for our products, and our ability to serve those markets;
- the rate and degree of market acceptance of our products;
- ability to expand our sales organization to address effectively existing and new markets that we intend to target;
- impact from future regulatory, judicial, and legislative changes or developments in the U.S. and foreign countries;
- ability to compete effectively in a competitive industry;
- the success of competing technologies that are or may become available;
- the performance of our third-party contract sales organizations, suppliers and manufacturers;
- our ability to attract and retain key scientific or management personnel;
- the accuracy of our estimates regarding expenses, future revenues, reimbursement rates, capital requirements and needs for additional financing;
- our ability to obtain funding for our operations;
- our ability to attract collaborators and strategic partnerships; and
- our use of the 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, results of operations and prospects. The outcome of the events described in these forward-looking statements is subject to risks, uncertainties and other factors described in “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. And

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, including market size and growth rates of the markets in which we participate, that are based on industry publications and reports. This information involves many assumptions and limitations, and you are cautioned not to give undue weight to these estimates. We have not independently verified the accuracy or completeness of the data contained in these industry publications and reports. The industry in which we operate is subject to a high degree of uncertainty and risk due to a variety of factors, including those described in “Risk Factors,” that could cause results to differ materially from those expressed in these publications and reports.

## USE OF PROCEEDS

We estimate that we will receive net proceeds from this offering of approximately \$17.3 million (or approximately \$20.2 million if the underwriters' option to purchase additional units from us is exercised in full) based on the initial public offering price of \$6.125 per unit, after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

We intend to use the net proceeds from the offering as follows: (1) \$10.0 million towards expanding our commercial operations to grow and support the installed base of our products among life sciences basic research, translational research and clinical-related customers in the U.S. and internationally; (2) \$4.0 million towards improving and updating our technology and instruments and towards developing additional labeling reagents; (3) \$0.5 million towards potentially establishing a direct commercialization presence in China; (4) \$0.5 million towards assisting existing and future partners in pursuing regulatory approvals or clearances to develop instruments and consumables in areas outside of life science research, including potentially LDTs; and (5) the remainder to fund working capital and other general corporate purposes.

We also may use a portion of the net proceeds from the offering to fund acquisitions or other business development opportunities. However, we have no current commitments or obligations with respect to any such acquisitions or business development opportunities at this time.

The expected use of net proceeds from this offering represents our intentions based upon our present plans and business conditions. We cannot predict with certainty all of the particular uses for the proceeds of this offering or the amounts that we will actually spend on the uses set forth above. Accordingly, we will have significant flexibility in applying the net proceeds of this offering. The timing and amount of our actual expenditures will be based on many factors, including cash flows from operations and the anticipated growth of our business. Pending their use, we intend to invest the net proceeds of 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 do not anticipate declaring or paying, in the foreseeable future, any cash dividends on our capital stock. We 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, if any, 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 are currently prohibited from paying dividends on our common stock without the prior written consent of Midcap, our senior lender.

**CAPITALIZATION**

The following table sets forth our cash and cash equivalents and capitalization as of June 30, 2018:

- on an actual basis;
- on a pro forma basis, giving effect to (i) the automatic conversion of all of our outstanding shares of convertible preferred stock into an aggregate of 2,850,280 shares of common stock, (ii) the conversion of approximately \$14.4 million aggregate principal amount of outstanding convertible promissory notes plus accrued interest thereon into 3,203,107 shares of common stock (based on the initial public offering price of \$6.125 per unit and a conversion date of June 30, 2018); and
- on a pro forma as adjusted basis, giving effect to (i) the pro forma adjustments set forth above and (ii) our receipt of estimated net proceeds from the sale of 3,360,000 units in the offering at the initial public offering price of \$6.125 per unit, after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us.

You should read this table together with “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and our financial statements and related notes included elsewhere in this prospectus.

	As of June 30, 2018		
	Actual	Pro Forma (unaudited)	Pro Forma As Adjusted
Cash and cash equivalents	\$ 7,624,289	\$ 7,624,289	\$ 24,948,189
Long-term debt	8,956,143	8,956,143	8,956,143
Convertible note	14,329,843	—	—
Preferred stock warrant liability	1,604,836	—	—
Convertible preferred stock, \$0.0001 par value; 218,982,477 shares authorized, 121,992,497 shares issued and outstanding, actual, and no shares authorized, issued and outstanding, pro forma and pro forma as adjusted	43,010,137	—	—
Stockholders’ deficit:			
Common stock, \$0.0001 par value; 244,097,620 shares authorized, actual, 78,045 shares issued and outstanding, actual; 244,097,620 shares authorized, pro forma; 6,131,142 shares issued and outstanding, pro forma; 244,097,620 shares authorized, pro forma as adjusted; 9,491,432 shares issued and outstanding, pro forma as adjusted	8	613	949
Additional paid-in capital	4,147,255	63,091,466	80,415,030
Accumulated deficit	(61,424,874)	(61,424,874)	(61,424,874)
Total stockholders’ (deficit) equity	(57,277,611)	1,667,205	18,991,105
Total capitalization	\$ 10,623,348	\$ 10,623,348	\$ 27,947,248

If the underwriters’ option to purchase additional units from us is exercised in full, pro forma as adjusted cash and cash equivalents, additional paid-in capital, total stockholders’ (deficit) equity, total capitalization and shares of common stock outstanding as of June 30, 2018 would be \$27.8M, \$83.3M, \$21.9M, \$30.8M and 10.0M, respectively.

The number of shares of our common stock to be outstanding after this offering is based on 2,928,325 shares of our common stock as of June 30, 2018, after giving effect to the conversion of shares of our convertible



preferred stock outstanding as of June 30, 2018 into an aggregate of 2,850,280 shares of our common stock immediately prior to the closing of this offering, and excludes:

- 416,937 shares of our common stock issuable upon the exercise of stock options outstanding as of June 30, 2018 under our Amended and Restated 2006 Equity Compensation Plan, as amended, or 2006 Plan, with a weighted-average exercise price of \$5.05 per share;
- 1,499,454 shares of our common stock reserved for future issuance under our 2018 Equity Incentive Plan, or 2018 Plan, which will become effective once the registration statement of which this prospectus forms a part is declared effective, with such shares including 1,000,000 new shares plus the number of shares (not to exceed 499,454 shares) (i) that remain available for the issuance of awards under our 2006 Plan at the time our 2018 Plan becomes effective, and (ii) any shares underlying outstanding stock awards granted under our 2006 Plan that expire or are repurchased, forfeited, cancelled or withheld, as more fully described in the section titled “Executive Compensation – Equity Incentive Plans”;
- 175,000 shares of our common stock reserved for issuance under our 2018 Employee Stock Purchase Plan, or ESPP, which will become effective once the registration statement of which this prospectus forms a part is declared effective, and any automatic increases in the number of shares of common stock reserved for future issuance under our ESPP;
- 1,001 shares of our common stock issuable upon the exercise of an outstanding warrant which, prior to the completion of this offering, is exercisable for 42,872 shares of our Series B convertible preferred stock;
- 1,752 shares of our common stock issuable upon the exercise of outstanding warrants which, prior to the completion of this offering, are exercisable for 75,027 shares of our Series B-1 convertible preferred stock;
- 11,925 shares of our common stock issuable upon the exercise of an outstanding warrant which, prior to the completion of this offering, is exercisable for 510,417 shares of our Series D convertible preferred stock;
- 21,416 shares of our common stock issuable upon the exercise of an outstanding warrants which, prior to the completion of this offering, are exercisable for 916,667 shares of our Series D-1 convertible preferred stock; and
- up to 115,920 shares of common stock issuable upon exercise of warrants to be issued to the Underwriters in connection with this offering, which will have an exercise price per share equal to 150% of the initial public offering price per unit in this offering.

Unless we specifically state otherwise, the information in this prospectus assumes or gives effect to:

- the filing of our amended and restated certificate of incorporation, which will be in effect upon the completion of this offering;
- the conversion of all of our outstanding shares of convertible preferred stock into an aggregate of 2,850,280 shares of common stock upon the closing of this offering;
- the conversion of outstanding convertible promissory notes into 3,203,107 shares of common stock (based on the initial public offering price of \$6.125 per unit and a conversion date of June 30, 2018);
- that the initial public offering price of our units is \$6.125 per unit;
- no exercise of the outstanding options described above;
- no exercise of the underwriters’ option to purchase up to an additional 504,000 units from us in this offering; and
- a 1-for-21.4 reverse stock split of our common stock effected on July 16, 2018 and a subsequent 1-for-2 reverse stock split of our common stock effected on August 15, 2018.

## DILUTION

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

Our pro forma net tangible book value as of June 30, 2018 was \$1.7 million, or \$0.27 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 our shares of common stock outstanding as of June 30, 2018, after giving effect to (i) the automatic conversion of all of our outstanding shares of convertible preferred stock into an aggregate of 2,850,280 shares of common stock, and (ii) the conversion of approximately \$14.4 million aggregate principal amount of outstanding convertible promissory notes plus accrued interest thereon into 3,203,107 shares of common stock (based on the initial public offering price of \$6.125 per unit and a conversion date of June 30, 2018).

After giving effect to the sale by us of 3,360,000 units in this offering at the initial public offering price of \$6.125 per unit, and after deducting estimated underwriting discounts, commissions and estimated offering expenses payable by us, our pro forma as adjusted net tangible book value as of June 30, 2018 would have been \$19.0 million, or \$2.00 per share. This amount represents an immediate increase in pro forma as adjusted net tangible book value of \$1.73 per share to our existing stockholders and an immediate dilution in pro forma as adjusted net tangible book value of \$4.13 per unit to investors purchasing units in this offering. We determine dilution by subtracting the pro forma as adjusted net tangible book value per share after this offering from the amount of cash paid by an investor for a unit in this offering. The following table illustrates this dilution on a per share basis:

Assumed initial public offering price per unit	\$6.125
Historical net tangible book value (deficit) per share as of June 30, 2018	\$(733.90)
Increase in historical net tangible book value (deficit) per share attributable to pro forma adjustments described above	\$ 734.17
Pro forma net tangible book value (deficit) per share as of June 30, 2018	\$ 0.27
Increase in pro forma as adjusted net tangible book value per share attributable to new investors purchasing units in this offering	\$ 1.73
Pro forma as adjusted net tangible book value per share after this offering	\$ 2.00
Dilution per unit to new investors purchasing units in this offering	\$ 4.13

If the underwriters exercise their option to purchase additional units in full, the pro forma net tangible book value per share, as adjusted to give effect to this offering, would be \$0.19 per share, and the dilution in pro forma net tangible book value per unit to investors in this offering would be \$0.19 per unit.

The number of shares of our common stock to be outstanding after this offering is based on 2,928,325 shares of our common stock as of June 30, 2018, after giving effect to the conversion of shares of our convertible preferred stock outstanding as of June 30, 2018 into an aggregate of 2,850,280 shares of our common stock immediately prior to the closing of this offering, and excludes:

- 416,937 shares of our common stock issuable upon the exercise of stock options outstanding as of June 30, 2018 under our 2006 Plan with a weighted-average exercise price of \$5.05 per share;
- 1,499,454 shares of our common stock reserved for future issuance under the 2018 Plan, which will become effective once the registration statement of which this prospectus forms a part is declared effective, with such shares including 1,000,000 new shares plus the number of shares (not to exceed 499,454 shares) (i) that remain available for the issuance of awards under our 2006 Plan at the time our 2018 Plan becomes effective, and (ii) any shares underlying outstanding stock awards granted under

our 2006 Plan that expire or are repurchased, forfeited, cancelled or withheld, as more fully described in the section titled “Executive Compensation – Equity Incentive Plans”;

- 175,000 shares of our common stock reserved for issuance under the ESPP, which will become effective once the registration statement of which this prospectus forms a part is declared effective, and any automatic increases in the number of shares of common stock reserved for future issuance under our ESPP;
- 1,001 shares of our common stock issuable upon the exercise of an outstanding warrant which, prior to the completion of this offering, is exercisable for 42,872 shares of our Series B convertible preferred stock;
- 1,752 shares of our common stock issuable upon the exercise of outstanding warrants which, prior to the completion of this offering, are exercisable for 75,027 shares of our Series B-1 convertible preferred stock;
- 11,925 shares of our common stock issuable upon the exercise of an outstanding warrant which, prior to the completion of this offering, is exercisable for 510,417 shares of our Series D convertible preferred stock;
- 21,416 shares of our common stock issuable upon the exercise of an outstanding warrants which, prior to the completion of this offering, are exercisable for 916,667 shares of our Series D-1 convertible preferred stock; and
- up to 115,920 shares of common stock issuable upon exercise of warrants to be issued to the Underwriters in connection with this offering, which will have an exercise price per share equal to 150% of the initial public offering price per unit in this offering.

To the extent that any outstanding options or warrants are exercised or new options are issued under our stock-based compensation plans, or we issue additional shares of common stock in the future, there will be further dilution to investors participating in this offering. In addition, we may choose to raise additional capital because of market conditions or strategic considerations, even if we believe that we have sufficient funds for our current or future operating plans. If we raise additional capital through the sale of equity or convertible debt securities, the issuance of these securities could result in further dilution to our stockholders.

Certain of our existing stockholders, including entities affiliated with them or with certain of our directors, have indicated an interest in purchasing an aggregate of approximately \$13.0 million in units in this offering at the initial public offering price per unit. Based on the initial public offering price of \$6.125 per unit, these persons and entities would purchase an aggregate of approximately 2,122,449 of the 3,360,000 units in this offering based on these indications of interest. However, because indications of interest are not binding agreements or commitments to purchase, the underwriters may determine to sell more, less or no units in this offering to any of these persons or entities, or any of these persons or entities may determine to purchase more, less or no units in this offering. The foregoing discussion and tables do not reflect any potential purchases by these persons or entities or their affiliated entities.

**SELECTED FINANCIAL DATA**

The selected statements of operations data for the years ended December 31, 2016 and 2017 and the balance sheet data as of December 31, 2016 and 2017 are derived from our audited financial statements that are included elsewhere in this prospectus. The selected statements of operations data for the six months ended June 30, 2017 and 2018 and the balance sheet data as of June 30, 2018 are derived from our unaudited financial statements that are included elsewhere in this prospectus. Our historical results are not necessarily indicative of our results in any future period and results from our interim period may not necessarily be indicative of the results of the entire year.

You should read the following selected financial data together with “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and our financial statements and the related notes included elsewhere in this prospectus. The selected financial data in this section are not intended to replace our financial statements and the related notes and are qualified in their entirety by the financial statements and related notes included elsewhere in this prospectus.

	<u>Year ended December 31,</u>		<u>Six Months Ended June 30,</u>	
	<u>2016</u>	<u>2017</u>	<u>2017</u>	<u>2018</u>
			(unaudited)	
Total revenue	\$ 6,792,789	\$ 9,505,043	\$ 3,916,864	\$ 5,158,494
Operating expenses				
Cost of revenue	3,578,692	6,030,512	2,844,117	2,654,879
Research and development	11,431,941	12,009,170	6,584,614	4,465,919
Selling, general and administrative	12,950,572	14,079,658	7,436,426	6,385,378
Impairment of property and equipment	—	604,511	—	—
Total operating expenses	27,961,205	32,723,851	16,865,157	13,506,176
Interest expense	(470,072)	(590,927)	(286,095)	(709,616)
Other income	2,802,797	462,923	896,758	1,907,742
Provision for income taxes	(12,924)	(18,552)	(22,358)	(9,282)
Net loss	<u>\$ (18,848,615)</u>	<u>\$ (23,365,364)</u>	<u>\$ (12,359,988)</u>	<u>\$ (7,158,838)</u>
Net loss per share <sup>(1)</sup> :				
Basic and diluted	\$ (312.46)	\$ (327.78)	\$ (176.12)	\$ (92.23)
Pro forma net loss per share <sup>(1)</sup> :				
Basic and diluted		\$ (8.65)		\$ (1.37)

- (1) See Note 2 of the notes to our financial statements included elsewhere in this prospectus for a description of how we compute basic and diluted net income per share attributable to common stockholders and preferred stockholders and pro forma basic and diluted net loss per share attributable to common stockholders.

	<u>Year Ended December 31</u>		<u>As of June 30</u>
	<u>2016</u>	<u>2017</u>	<u>2018</u>
			(unaudited)
<b>Balance Sheet Data:</b>			
Cash and cash equivalents	\$ 5,249,620	\$ 1,021,897	\$ 7,624,289
Working capital	1,371,819	(9,512,886)	(6,773,417)
Total assets	14,787,737	10,145,153	18,094,156
Convertible note	—	—	14,329,843
Long-term debt	6,633,176	6,729,752	8,956,143
Total liabilities	16,630,182	17,362,227	32,361,630
Convertible preferred stock	25,416,527	43,010,137	43,010,137
Accumulated deficit	(30,900,672)	(54,266,036)	(61,424,874)
Total stockholders’ (deficit) equity	(27,258,972)	(50,227,211)	(57,277,611)

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

The following discussion should be read in conjunction with the "Selected Financial Data" and our financial statements and related notes thereto included elsewhere in this prospectus. In addition to historical information, this discussion contains forward-looking statements that involve risks, uncertainties and assumptions that could cause actual results to differ materially from management's expectations. Factors that could cause such differences are discussed in the sections entitled "Special Note Regarding Forward-Looking Statements" and "Risk Factors." We are not undertaking any obligation to update any forward-looking statements or other statements we may make in the following discussion or elsewhere in this document even though these statements may be affected by events or circumstances occurring after the forward-looking statements or other statements were made. Therefore, no reader of this document should rely on these statements being current as of any time other than the time at which this document is declared effective by the U.S. Securities and Exchange Commission.

### Overview

We are a life sciences instrumentation company in the genome analysis space. We develop and market the Saphyr system, a platform for ultra-sensitive and ultra-specific structural variation detection that enables researchers and clinicians to accelerate the search for new diagnostics and therapeutic targets and to streamline the study of changes in chromosomes, which is known as cytogenetics. Our Saphyr system comprises an instrument, chip consumables, reagents and a suite of data analysis tools.

Structural variation refers to large-scale structural differences in the genomic DNA of one individual compared to another. Each structural variation involves the rearrangement or repetition of as few as hundreds to as many as tens of millions of DNA base pairs. Those rearrangements may be insertions, deletions, duplications, inversions or translocations of segments of one or more chromosomes. Structural variations may be inherited or arise spontaneously and many cause genetic disorders and diseases. Until our commercial launch of the Saphyr system in February 2017, and since, we believe no products existed or exist that could more comprehensively and cost and time-efficiently detect structural variation.

Our Saphyr system comprises an instrument, chip consumables, reagents and a suite of data analysis tools. Our customers include researchers and clinicians who seek to uncover and understand the biological or clinical impact of genome variation to improve the diagnosis and treatment of patients with better clinical tests and new medicines or to replace existing cytogenetic tests that are expensive, slow and labor-intensive, with a modern solution that simplifies workflow and reduces costs and that has the potential to significantly increase diagnostic yields across the industry. Our customers also include researchers in non-human segments such as agricultural genomics where they seek to advance their understanding of how structural variation impacts industrial applications of plants and animals.

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

Since our inception, we have raised net equity proceeds of \$129.3 million to fund our operations from the issuance of convertible preferred stock and convertible promissory notes. We have incurred losses in each year since our inception. Our net losses were \$18.8 million and \$23.4 million for the years ended December 31, 2016 and 2017, respectively, and \$12.4 million and \$7.2 million for the six months ended June 30, 2017 and 2018, respectively. As of June 30, 2018, we had an accumulated deficit of \$61.4 million.

We expect to continue to incur significant expenses and operating losses as we:

- expand our sales and marketing efforts to further commercialize our products;

- continue research and development efforts to improve our existing products;
- hire additional personnel;
- enter into collaboration arrangements, if any;
- add operational, financial and management information systems; and
- incur increased costs as a result of operating as a public company.

## Financial Overview

### Revenue

We generate product revenue from sales of our instruments and consumables. We currently sell our products for research use only applications and our customers are primarily laboratories associated with academic and governmental research institutions, as well as pharmaceutical, biotechnology and contract research companies. Sales of our consumables have consistently increased due to an increasing number of our instruments being installed in the field, all of which require certain of our consumables to run customers' specific tests. Consumable revenue consists of sales of complete assays which are developed internally by us, plus sales of kits which contain all the elements necessary to run tests.

Other revenue consists of warranty and other service-based revenue.

The following table presents our revenue for the periods indicated:

	Year Ended December 31,		Six Months Ended June 30,	
	2016	2017	2017	2018
			(unaudited)	
Product revenue	\$ 6,153,355	\$ 8,769,704	\$ 3,609,281	\$ 4,918,245
Other revenue	639,434	735,339	307,583	240,249
<b>Total</b>	<b>\$ 6,792,789</b>	<b>\$ 9,505,043</b>	<b>\$ 3,916,864</b>	<b>\$ 5,158,494</b>

The following table reflects total revenue by geography and as a percentage of total revenue, based on the billing address of our customers. North America consists of the United States and Canada. EMEIA consists of Europe, Middle East, India and Africa. Asia Pacific includes China, Japan, South Korea, Singapore and Australia.

	Year Ended December 31,				Six Months Ended June 30,			
	2016		2017		2017		2018	
	\$	%	\$	%	\$	%	\$	%
	(unaudited)							
North America	\$2,078,987	31%	\$3,801,481	40%	\$1,794,728	46%	\$2,553,428	49%
EMEIA	1,666,188	24%	1,282,897	13%	819,464	21%	1,128,510	22%
Asia Pacific	3,047,614	45%	4,420,665	47%	1,302,672	33%	1,476,556	29%
<b>Total</b>	<b>\$6,792,789</b>	<b>100%</b>	<b>\$9,505,043</b>	<b>100%</b>	<b>\$3,916,864</b>	<b>100%</b>	<b>\$5,158,494</b>	<b>100%</b>

Subsequent to the issuance of the June 30, 2018 unaudited condensed consolidated financial statements, we discovered an error in the disclosure of revenue amounts for the six months ended June 30, 2018 within the North America, EMEIA and Asia Pacific geographic regions. Accordingly, the table above has been restated to correct the June 30, 2018 disclosures of revenue for the North America, EMEIA and Asia Pacific geographic regions, resulting in increases (decreases) from amounts previously reported of \$837,451, \$239,421, and \$(1,076,872), respectively.

**Cost of Revenue**

Cost of revenue for our instruments and consumables includes cost from the manufacturer, raw material parts costs and associated freight, shipping and handling costs, contract manufacturer costs, salaries and other personnel costs, overhead and other direct costs related to those sales recognized as product revenue in the period.

Cost of other revenue consists of salaries and other personnel costs and costs related to warranties and other costs of servicing equipment at customer sites.

**Research and Development Expenses**

Research and development expenses consist of salaries and other personnel costs, stock-based compensation, research supplies, third-party development costs for new products, materials for prototypes, and allocated overhead costs that include facility and other overhead costs. We have made substantial investments in research and development since our inception, and plan to continue to make investments in the future. Our research and development efforts have focused primarily on the tasks required to support development and commercialization of new and existing products. We believe that our continued investment in research and development is essential to our long-term competitive position.

**Selling, General and Administrative Expenses**

Selling, general and administrative expenses consist primarily of salaries and other personnel costs, and stock-based compensation for our sales and marketing, finance, legal, human resources and general management, as well as professional services, such as legal and accounting services.

**Results of Operations**

**Comparison of the Six Months Ended June 30, 2017 and 2018**

The following table sets forth our results of operations for the six months ended June 30, 2017 and 2018:

	<u>Six Months Ended June 30,</u>		<u>Period-to-Period Change</u>	
	<u>2017</u>	<u>2018</u>	<u>\$</u>	<u>%</u>
		(unaudited)		
Product revenue	\$ 3,609,281	\$ 4,918,245	\$ 1,308,964	36.3%
Other revenue	307,583	240,249	(67,334)	-21.9%
<b>Total revenue</b>	<b>3,916,864</b>	<b>5,158,494</b>	<b>1,241,630</b>	<b>31.7%</b>
Cost of product revenue	2,818,861	2,644,043	(174,818)	-6.2%
Cost of other revenue	25,256	10,836	(14,420)	-57.1%
Research and development	6,584,614	4,465,919	(2,118,695)	-32.2%
Selling, general and administrative	7,436,426	6,385,378	(1,051,048)	-14.1%
<b>Total operating expenses</b>	<b>16,865,157</b>	<b>13,506,176</b>	<b>(3,358,981)</b>	<b>-19.9%</b>
Loss from operations	(12,948,293)	(8,347,682)	4,600,611	-35.5%
Interest expense	(286,095)	(709,616)	(423,521)	-148.0%
Change in fair value of preferred stock warrants and expirations	953,893	2,470,921	1,517,028	159.0%
Other expense	(57,135)	(563,179)	(506,044)	-885.7%
Loss before income taxes	(12,337,630)	(7,149,556)	5,188,074	-42.1%
Provision for income taxes	(22,358)	(9,282)	13,076	-58.5%
<b>Net loss</b>	<b>\$(12,359,988)</b>	<b>\$(7,158,838)</b>	<b>\$(5,201,150)</b>	<b>-42.1%</b>

#### *Revenue*

Revenue increased by \$1.2 million, or 31.7%, to \$5.2 million for the six months ended June 30, 2018, as compared to \$3.9 million for the same period in 2017. Average sales prices, or ASPs, of instruments decreased by 7% while consumables increased by 37%, respectively in the six months ended June 30, 2018, as compared with the six months ended June 30, 2017. We began selling our new Saphyr system in February 2017 which includes higher priced consumables than those sold under our previously marketed, first generation system Irys. In addition, sales volumes of instruments and consumables increased by 17% and 160%, respectively in the six months ended June 30, 2018, as compared with the six months ended June 30, 2017.

#### *Cost of Revenue*

Cost of product revenue decreased by \$0.2 million, or 6.2%, to \$2.6 million for the six months ended June 30, 2018, as compared to \$2.8 million for the same period in 2017. The decrease was primarily due to the increase in consumable revenue relative to instrument revenue for the six months ended June 30, 2018, as compared to the same period in 2017. Cost of revenues could adversely be affected if we are unable to sell our remaining Irys instruments at the current carrying amount of \$1.3 million.

#### *Research and Development Expenses*

Research and development expenses decreased \$2.1 million, or 32.2%, to \$4.5 million for the six months ended June 30, 2018 compared to \$6.6 million for the same period in 2017. The decrease in research and development expenses during this period was primarily related to decreases in compensation and benefit expense as a result in a reduction in headcount during the second half of 2017.

#### *Selling, General and Administrative Expenses*

Selling, general and administrative expenses were \$7.4 million and \$6.4 million for the six months ended June 30, 2017 and 2018, respectively. The decrease in selling, general and administrative expenses during this period of \$1.0 million was primarily related to decreases in compensation and benefit expense as a result of a reduction in headcount during the second half of 2017. We expect selling, general and administrative expenses to increase in future periods as the number of sales, technical support and marketing and administrative personnel grows and we continue to broaden our customer base and grow our business. We also expect to incur additional expenses as a public company, including expenses related to compliance with the rules and regulations of the SEC and Nasdaq, additional insurance expenses, and expenses related to investor relations activities and other administrative and professional services.

#### *Interest Expense*

Interest expense increased from \$0.3 million to \$0.7 million for the six months ended June 30, 2017 and 2018, respectively. The increase in interest expense is related to additional borrowing of convertible notes entered into during the six months ended June 30, 2018.

#### *Change in Fair Value of Preferred Stock Warrants*

Change in fair value of preferred stock warrants was \$1.0 million and \$2.5 million for the six months ended June 30, 2017 and 2018, respectively. The preferred stock warrants are subject to remeasurement at each reporting period, with changes in fair value recorded in the statement of operations.

#### *Other Expense*

Other expense was \$0.1 million and \$0.6 million for the six months ended June 30, 2017 and 2018, respectively. The increase is related to financing expenses incurred to extinguish the Western Alliance LSA during the six months ended June 30, 2018.



### Comparison of the Years Ended December 31, 2016 and 2017

The following table sets forth our results of operations for the years ended December 31, 2016 and 2017:

	Year Ended December 31,		Period-to-Period Change	
	2016	2017	\$	%
Product revenue	\$ 6,153,355	\$ 8,769,704	\$ 2,616,349	42.5%
Other revenue	639,434	735,339	95,905	15.0%
<b>Total revenue</b>	<b>6,792,789</b>	<b>9,505,043</b>	<b>2,712,254</b>	<b>39.9%</b>
Cost of product revenue	3,459,771	5,958,537	2,498,766	72.2%
Cost of other revenue	118,921	71,975	(46,946)	-39.5%
Research and development	11,431,941	12,009,170	577,229	5.0%
Selling, general and administrative	12,950,572	14,079,658	1,129,086	8.7%
Impairment of property and equipment	—	604,511	604,511	N/A
<b>Total operating expenses</b>	<b>27,961,205</b>	<b>32,723,851</b>	<b>4,762,646</b>	<b>17.0%</b>
Loss from operations	(21,168,416)	(23,218,808)	(2,050,392)	9.7%
Interest expense	(470,072)	(590,927)	(120,855)	-25.7%
Change in fair value of preferred stock warrants and expirations	3,006,082	751,933	(2,254,149)	-75.0%
Other expense	(203,285)	(289,010)	(85,725)	-42.2%
Loss before income taxes	(18,835,691)	(23,346,812)	(4,511,121)	23.9%
Provision for income taxes	(12,924)	(18,552)	(5,628)	43.5%
<b>Net loss</b>	<b>\$(18,848,615)</b>	<b>\$(23,365,364)</b>	<b>\$ 4,516,749</b>	<b>24.0%</b>

#### Revenue

Revenue increased by \$2.7 million, or 39.9% to \$9.5 million for the year ended December 31, 2017, as compared to \$6.8 million for the same period in 2016. ASPs of instruments and consumables increased in the year ended December 31, 2017, as compared with the year ended December 31, 2016 as we began selling our new Saphyr system, which includes higher priced instruments and consumables, in February 2017. The vast majority of the increase in product revenue of \$2.6 million was due to a 37% increase in instrument unit sales and a 4% increase in consumable unit sales in the year ended December 31, 2017, as compared to 2016; higher priced instruments (instrument ASP increased 6%) and consumables (consumable ASP increased 18%) also contributed to the increase in product revenue, but to a much lesser extent than the increase in sales volume. The increase in other revenue of \$0.1 million was due to increased warranty revenues.

#### Cost of Revenue

Cost of product revenue increased by \$2.5 million, or 72.2%, to \$6.0 million for the year ended December 31, 2017, as compared to \$3.5 million for the same period in 2016. The increase was primarily due to increased sales of instruments and consumables and write-downs of Irys instruments (the predecessor to our Saphyr instrument) of \$0.4 million included in inventory to net realizable value during 2017. During the year ended December 31, 2017, we also incurred higher costs related to the manufacturing of our instruments due to purchase quantities at lower volumes on a per-batch basis. In order to manage working capital, instruments were ordered as needed, limiting volume based purchase discounts. We expect the cost of product revenue per instrument to decrease in future periods as we benefit from economies of scale and modifications to the components and assembly over time. Cost of revenues could adversely be affected if we are unable to sell our remaining Irys instruments at the current carrying amount of \$1.3 million.

*Research and Development Expenses*

Research and development expenses were relatively consistent at \$11.4 million and \$12.0 million for the year ended December 31, 2016 and 2017, respectively. During 2017, we began to transition our efforts from research and development to the commercialization of our products. As part of commercialization effort we reduced headcount related to research and development personnel during the second half of 2017. We expect our research and development expenses will be lower in the near term due to this transition.

*Selling, General and Administrative Expenses*

Selling, general and administrative expenses were \$13.0 million and \$14.1 million for the years ended December 31, 2016 and 2017, respectively. The increase in selling, general and administrative expenses during this period of \$1.1 million was primarily related to increases in marketing expense due to the launch of Saphyr, our new product platform, in February 2017 and increased headcount for customer support services. We expect selling, general and administrative expenses to increase in future periods as the number of sales, technical support and marketing and administrative personnel grows and we continue to broaden our customer base and grow our business. We also expect to incur additional expenses as a public company, including expenses related to compliance with the rules and regulations of the SEC and Nasdaq, additional insurance expenses, and expenses related to investor relations activities and other administrative and professional services.

*Impairment of Property and Equipment*

We did not recognize any impairment losses during the year ended December 31, 2016. During the year ended December 31, 2017, we recognized an impairment loss of \$0.6 million related to our Irys instruments at customer sites as the carrying amount of the assets were determined to be in excess of the assets fair value.

*Interest Expense*

Interest expense was relatively consistent with \$0.5 million and \$0.6 million for the year ended December 31, 2016 and 2017, respectively.

*Change in Fair Value of Preferred Stock Warrants*

Change in fair value of preferred stock warrants was \$3.0 million and \$0.8 million for the year ended December 31, 2016 and 2017, respectively. The preferred stock warrants are subject to remeasurement at each reporting period, with changes in fair value recorded in the statement of operations.

*Other Expense*

Other expense was relatively consistent with \$0.2 million and \$0.3 million for the year ended December 31, 2016 and 2017, respectively.

**Liquidity and Capital Resources**

Since our inception, we have incurred net losses and negative cash flows from operations. We incurred net losses of \$18.8 million, \$23.4 million, and \$7.2 million, and used \$23.5 million, \$20.8 million and \$9.8 million of cash from our operating activities for the years ended December 31, 2016 and 2017 and the six months ended June 30, 2018, respectively. As of June 30, 2018, we had an accumulated deficit of \$61.4 million and cash and cash equivalents of \$7.6 million.

**Sources of Liquidity**

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

*Preferred stock financings*

As of December 31, 2017, we had raised approximately \$129.3 million in net equity proceeds through sales of our preferred stock, including the sale of 49,819,157 shares of our Series D and D-1 convertible preferred stock and warrants to purchase 31,672,817 shares of our Series D convertible preferred stock, during the year ended December 31, 2016 at a purchase price of \$0.48 per share for net proceeds of \$23.5 million.

During the year ended December 31, 2017, we also issued 36,974,586 shares of Series D-1 Preferred Stock at a purchase price of \$0.48 per share for net proceeds of \$17.6 million.

See Note 8 to our consolidated financial statements for a discussion of the terms and provisions of our Series D and Series D-1 Preferred Stock issued in 2016 and 2017.

*Loan facility*

On March 8, 2016, we entered into a new term Loan and Security Agreement with Western Alliance Bank, or the Western Alliance LSA, for \$7.0 million. The loan proceeds were used to repay the outstanding \$5.0 million loan with Square 1 Bank, as required by the amended Loan and Security agreement between Square 1 Bank and us.

We received a notice of default from Western Alliance Bank notifying us that we were in default as of December 31, 2017, as we had failed to secure at least \$15.0 million from the sale or issuance of our equity securities or subordinated debt as set forth in the amended Western Alliance LSA. Based on the loan default notice we determined to reclassify the total loan balance of approximately \$6.7 million to current liabilities on the consolidated balance sheet as of December 31, 2017, as the loan could be called at any time by Western Alliance Bank.

In February 2018, the Western Alliance LSA was amended requiring the Company to secure \$21.0 million in funding prior to June 30, 2018. As part of the amendment, Western Alliance Bank agreed to forbear from exercising any of its default remedies set forth in the LSA as a result of our loan default.

On June 13, 2018, the Western Alliance LSA was amended, replacing previously amended funding requirements and requiring the Company to secure \$5.0 million in funding prior to August 3, 2018. Additionally, the amendment restricted the Company's use of all cash collected from customers, received on and after the amendment date, until a total of \$2.5 million of collections. As part of the amendment, Western Alliance Bank waived the existing default.

On June 29, 2018, we entered into a new Credit and Security Agreement with Midcap Financial Trust which provides for a five year \$15 million term loan facility. The Credit and Security Agreement is secured by a lien covering substantially all of our assets, including intellectual property. Upon executing the agreement, we drew down a \$10.0 million term loan from the credit facility. The loan proceeds were used to repay the outstanding \$7.0 million balance on the Western Alliance LSA.

See Note 7 to our consolidated financial statements for a discussion of terms and provisions to the Western Alliance LSA and Midcap Financial CSA.

*Note purchase agreement*

On February 9, 2018, we entered into a Note Purchase Agreement with various investors, which included related parties, or the Investors, pursuant to which we agreed to sell the Investors 8% Convertible Promissory Notes, or the Convertible Notes, in the original principal amount up to approximately \$16.0 million. On April 2, 2018, we amended the Note Purchase Agreement to, among other things, increase the principal amount available

for issuance under the Note Purchase Agreement to approximately \$18.4 million. In addition, in connection with the Midcap Financial CSA, we again amended the Note Purchase Agreement to increase the amount available for issuance under the Note Purchase Agreement to approximately \$19.4 million. The Convertible Notes have a maturity date of September 30, 2018 and are convertible either into our common stock or preferred stock, dependent on the conversion events as described in Note 12 to our consolidated financial statements.

As of June 30, 2018, the Company had received proceeds of approximately \$14.4 million from the issuance of the Convertible Notes.

### **Cash Flows**

The following table sets forth the cash flow from operating, investing and financing activities for the periods presented:

	Year Ended December 31,		Six Months Ended June 30,	
	2016	2017	2017	2018
Net cash provided by (used in):			(unaudited)	
Operating activities	\$(23,496,358)	\$(20,817,798)	\$(12,353,518)	\$(9,753,922)
Investing activities	(1,349,853)	(1,017,830)	(461,939)	(189,401)
Financing activities	25,431,061	17,607,905	13,232,128	16,545,714

#### *Operating Activities*

We derive cash flows from operations primarily from the sale of our products and services. Our cash flows from operating activities are also significantly influenced by our use of cash for operating expenses to support the growth of our business. We have historically experienced negative cash flows from operating activities as we have developed our technology, expanded our business and built our infrastructure and this may continue in the future.

Net cash used in operating activities was \$12.4 million during the six months ended June 30, 2017 as compared to \$9.8 million during the six months ended June 30, 2018. The decrease in cash used in operating activities of \$2.6 million was the result of lower operating losses during the six months ended June 30, 2018 as compared to the six months ended June 30, 2017.

Net cash used in operating activities was \$23.5 million during the year ended December 31, 2016 as compared to \$20.8 million during the year ended December 31, 2017. The decrease in cash used in operating activities of \$2.7 million was primarily the result of increased revenues.

#### *Investing Activities*

Historically, our primary investing activities have consisted of capital expenditures for the purchase of capital equipment to support our expanding infrastructure. We expect to continue to incur additional costs for capital expenditures related to these efforts in future periods.

Net cash used in investing activities was \$0.5 million during the six months ended June 30, 2017 as compared to \$0.2 million during the six months ended June 30, 2018.

Net cash used in investing activities was \$1.4 million during the year ended December 31, 2016 as compared to \$1.0 million during the year ended December 31, 2017. The decrease in cash used in investing activities of \$0.4 million was the result of a decrease in the purchase of property and equipment in 2017.

### *Financing Activities*

Historically, we have financed our operations principally through private placements of our convertible preferred stock and promissory notes and borrowings from credit facilities, as well as gross profits from our commercial operations.

Net cash provided by financing activities was \$13.2 million during the six months ended June 30, 2017 as compared to \$16.5 million during the six months ended June 30, 2018. The increase in cash provided by financing activities of \$3.3 million was the result of proceeds from the issuance of convertible notes of approximately \$14.4 million during the six months ended June 30, 2018, compared to proceeds from the issuance (and in advance of issuance) of convertible preferred stock of \$13.2 million during the six months ended June 30, 2017. In addition, a new debt financing deal that closed in June 2018 produced net proceeds of approximately \$2.5 million.

Net cash provided by financing activities was \$25.4 million during the year ended December 31, 2016 as compared to \$17.6 million during the year ended December 31, 2017. The decrease in cash provided by financing activities of \$7.8 million was the result of the issuance of a smaller aggregate amount of convertible preferred stock in 2017 as compared to 2016.

### **Capital Resources**

We have not achieved profitability since our inception, and we expect to continue to incur net losses in the future. We also expect that our operating expenses will increase as we continue to increase our marketing efforts to drive adoption of our commercial products. Additionally, as a public company, we will incur significant audit, legal and other expenses that we did not incur as a private company. Our liquidity requirements have historically consisted, and we expect that they will continue to consist, of sales and marketing expenses, research and development expenses, working capital, debt service and general corporate expenses.

We believe that the net proceeds from this offering, together with our cash generated from commercial sales and our current cash and cash equivalents, including the proceeds from our recent financings, will be sufficient to meet our anticipated operating cash requirements for at least the next 18 months. We have based this belief on the following factors with respect to our anticipated operating cash requirements during the next 18 months:

- our expectation that our revenues during the next 18 months will be significantly higher than our historical revenues, due in part to the continued high rate of growth of instrument and consumables sales, which given our customers' recurring consumables purchasing patterns and our growing installed base of instruments, is expected to continue;
- our expectation that our gross margins during the next 18 months will be significantly higher than our historical gross margins, due in part to our projection that a larger proportion of our total revenues will be derived from higher-margin consumables sales relative to instrument sales; and
- our expectation that our research and development expenses and certain general and administration expenses during the next 18 months will be lower, or will grow at a significantly reduced rate, relative to prior periods due in part to a reduction in personnel in late 2017 and a significant reduction in the number, size and scope of research projects and product development initiatives.

In the future, we expect our operating and capital expenditures to increase as we increase headcount, expand our sales and marketing activities and grow our customer base. Our estimates of the period of time through which our financial resources will be adequate to support our operations and the costs to support research and development and our sales and marketing activities are forward-looking statements and involve risks and uncertainties and actual results could vary materially and negatively as a result of a number of factors, including the factors discussed in the section "Risk Factors" of this prospectus. We have based our estimates on

assumptions that may prove to be wrong and we could utilize our available capital resources sooner than we currently expect. Our future funding requirements will depend on many factors, including:

- market acceptance of our products;
- the cost and timing of establishing additional sales, marketing and distribution capabilities;
- the cost of our research and development activities; and
- the effect of competing technological and market developments.

We cannot assure you that we will be able to obtain additional funds on acceptable terms, or at all. If we raise additional funds by issuing equity or equity-linked securities, our stockholders may experience dilution. Future debt financing, if available, may involve covenants restricting our operations or our ability to incur additional debt. Any debt or equity financing that we raise may contain terms that are not favorable to us or our stockholders. If we do not have or are not able to obtain sufficient funds, we may have to reduce our commercialization efforts or delay our development of new products. We also may have to reduce marketing, customer support or other resources devoted to our products or cease operations.

### Contractual Obligations

The following summarizes our significant contractual obligations as of December 31, 2017:

Contractual Obligations	Payment Due by Period				
	Total	Less than 1 year	1-3 years	3-5 years	After 5 years
Operating leases	\$ 2,591,952	\$ 826,884	\$ 1,765,068	\$ —	\$ —
Principal payments, interest and end of term fees on loan	8,426,862	8,426,862	—	—	—
	<u>\$11,018,814</u>	<u>\$9,253,746</u>	<u>\$1,765,068</u>	<u>\$ —</u>	<u>\$ —</u>

Our operating lease obligations primarily relate to leases for our current headquarters in San Diego, California.

We also have ongoing obligations related to license agreements which contain immaterial minimum annual payments that are credited against the actual royalty expense, which are not included in the table above.

Purchase orders or contracts for the purchase of supplies and other goods and services are not included in the table above. We have a contractual commitment with a supplier to purchase \$0.1 million of products each quarter until the first quarter of 2019. We are not able to determine the aggregate amount of other such purchase orders that represent contractual obligations, as purchase orders may represent authorizations to purchase rather than binding agreements. Our purchase orders are based on our current procurement or development needs and are fulfilled by our vendors within short time horizons.

### Off-Balance Sheet Arrangements

We did not have during the periods presented, and we do not currently have, any off-balance sheet arrangements, as defined under SEC rules, and similarly did not and do not have any holdings in variable interest entities.

### Critical Accounting Policies and Estimates

Our management's discussion and analysis of our financial condition and results of operations is based on our consolidated financial statements, which have been prepared in accordance with generally accepted

accounting principles in the United States. The preparation of our consolidated financial statements requires us to make estimates and assumptions that affect the reported amounts of assets, liabilities and expenses and the disclosure of contingent assets and liabilities in our consolidated financial statements and accompanying notes. We evaluate these estimates and judgments on an ongoing basis. We base our estimates on historical experience and on various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

While our significant accounting policies are more fully described in Note 2 to our consolidated financial statements appearing elsewhere in this prospectus, we believe that the following accounting policies are the most critical for fully understanding and evaluating our financial condition and results of operations.

### **Revenue Recognition**

#### *Product Revenue*

Product revenue represents the sale of our instruments and consumables to third parties. Timing of revenue recognition on instrument sales is based upon when delivery has occurred, the price is fixed or determinable, and collectability is reasonably assured.

The majority of our instruments contain embedded operating systems and other software which is included in the purchase price of the instrument. The software is deemed incidental to the system as a whole as it is not sold or marketed separately and its production costs are minor compared to those of the hardware system. Hardware and software elements are both delivered when ownership is transferred to the customer.

Installation services for direct sale customers are performed at the same time or shortly after the product is delivered and require only a minimal effort to complete. We believe installation is a perfunctory service and is not material to our obligations in the contract.

#### *Other Revenue*

Other revenue includes revenue from extended service contracts and other services that may be performed. Revenue for extended warranty contracts is recognized ratably over the service period. Revenue for other services is generally recognized based on proportional performance of the contract, when the Company's ability to complete project requirements is reasonably assured. Deferred revenue represents amounts received in advance for on-going service arrangements. Most of these services are completed in a short period of time from the receipt of the customer's order. When significant risk exists in the Company's ability to fulfill project requirements, revenue is recognized upon completion of the contract.

#### *Multiple Element Arrangements*

We regularly enter into contracts where revenue is derived from multiple deliverables, including products or services. These contracts typically include an instrument, consumables, and extended service contracts. Revenue recognition for contracts with multiple deliverables is based on the individual units of accounting determined to exist in the contract. A delivered item is considered a separate unit of accounting when the delivered item has value to the customer on a stand-alone basis. Items are considered to have stand-alone value when they are sold separately by any vendor or when the customer could resell the item on a stand-alone basis.

For transactions with multiple deliverables, consideration is allocated at the inception of the contract to all deliverables based on their relative selling price. The relative selling price for each deliverable is determined using vendor-specific objective evidence, or VSOE, of selling price or third-party evidence of selling price if VSOE does not exist. If neither VSOE nor third-party evidence exists, we use our best estimate of the selling

price using average selling prices over an appropriate period coupled with an assessment of current market conditions. If the product or service has no history of sales or if the sales volume is not sufficient, we consider our approved standard prices adjusted for applicable discounts.

In order to establish VSOE of selling price, we must regularly sell the product or service on a standalone basis with a substantial majority priced within a relatively narrow range. In cases where there is not a sufficient number of standalone sales and VSOE of selling price cannot be determined, then we utilize third-party evidence to establish selling price.

#### *Distributor Transactions*

In certain markets, we sell products and provides services to customers through distributors that specialize in life sciences products. In cases where the product is delivered to a distributor, revenue recognition generally occurs when title transfers to the distributor. The terms of sales transactions through distributors are generally consistent with the terms of direct sales to customers, except the distributors do not require our services to install the instrument at the end customer and perform the services for the customer that are beyond our standard warranty in the first year following the sale. These transactions are accounted for in accordance with our revenue recognition policy described herein.

#### **Stock-Based Compensation Expense**

Stock-based compensation expense represents the cost of the grant date fair value of employee stock option grants recognized over the requisite service period of the awards (usually the vesting period) on a straight- line basis. We estimate the fair value of stock option grants using the Black-Scholes option-pricing model.

The Black-Scholes option-pricing model requires the use of subjective assumptions, including the risk- free interest rate, the expected stock price volatility, the expected term of stock options, the expected dividend yield and the fair value of the underlying common stock on the date of grant. See Note 8 to our consolidated financial statements included elsewhere in this prospectus for information concerning certain of the specific assumptions we used in applying the Black-Scholes option pricing model to determine the estimated fair value of our stock options granted in the years ended December 31, 2016 and 2017 and the six months ended June 30, 2017 and 2018.

#### *Determination of the Fair Value of Common Stock*

We are required to estimate the fair value of the common stock underlying our stock-based awards when performing the fair value calculations using the Black-Scholes option pricing model. Because our common stock is not currently publicly traded, the fair value of the common stock underlying our stock-based awards has been determined on each grant date by our board of directors, with input from management, considering our most recently available third-party valuation of common shares. All options to purchase shares of our common stock are intended to be granted with an exercise price per share no less than the fair value per share of our common stock underlying those options on the date of grant, based on the information known to us on the date of grant.

The third-party valuations of our common stock were performed using methodologies, approaches and assumptions consistent with the American Institute of Certified Public Accountants Audit and Accounting Practice Aid Series: *Valuation of Privately Held Company Equity Securities Issued as Compensation*. In addition, our board of directors considered various objective and subjective factors to determine the fair value of our common stock, including:

- the prices of our convertible preferred stock sold to investors in arm's length transactions;
- the rights, preferences and privileges of our convertible preferred stock as compared to those of our common stock, including the liquidation preferences of our convertible preferred stock;



- our results of operations and financial position;
- the composition of, and changes to, our management team and board of directors;
- the lack of liquidity of our common stock as a private company;
- the material risks related to our business and industry;
- external market conditions affecting the life sciences and biotechnology industry sectors;
- U.S. and global economic conditions;
- the likelihood of achieving a liquidity event for the holders of our common stock, such as an initial public offering, or IPO, or a sale of our company, given prevailing market conditions; and
- the market value and volatility of comparable companies.

Following the closing of this offering, the fair value of our common stock will be the closing price of our common stock on the date of the grant.

The fair value of the underlying preferred stock was determined using an Option Pricing Method, or OPM. Under the OPM, once the fair market value of the enterprise is established, shares are valued by creating a series of call options with exercise prices based on the liquidation preference and conversion behavior of the different classes of equity. Accordingly, the aggregate equity value is allocated to each of the classes of equity shares outstanding. The Company utilizes both the market and income approach to establish the fair market value of the enterprise.

Based on the initial public offering price of \$6.125 per unit, the intrinsic value of stock options outstanding as of December 31, 2017 would have been \$2.0 million, of which \$0.8 million and \$1.2 million would relate to stock options that were vested and unvested, respectively, at that date.

#### ***Preferred Stock Warrant Liability***

As of December 31, 2016, and 2017 and June 30, 2018, we had outstanding warrants to purchase 36,676,737, 36,603,557 and 37,228,557 shares of preferred stock, respectively. As of June 30, 2018, we had outstanding warrants to purchase 42,872 shares of Series B convertible preferred stock, 4,085,784 shares of Series B-1 convertible preferred stock, 32,183,234 shares of Series D convertible preferred stock and 916,667 shares of Series D-1 convertible preferred stock. See Note 8 to our consolidated financial statements included elsewhere in this prospectus for information concerning preferred stock warrant issuances during the years ended December 31, 2016 and 2017.

The warrants to purchase preferred stock are valued at each reporting period using the Black-Scholes-Merton model. This valuation includes observable inputs such as risk-free rate, as well as unobservable inputs for assumed volatility, the expected life of the warrants, and the fair value of the underlying preferred stock. See Note 3 to our consolidated financial statements included elsewhere in this prospectus for information concerning certain of the specific assumptions we used in applying the Black-Scholes option pricing model to determine the estimated fair value of our preferred stock warrants as of December 31, 2016 and 2017 and June 30, 2018. Following the closing of this offering, warrants to purchase an aggregate of 35,683,574 shares of preferred stock will be subject to automatic net exercise and termination, and warrants to purchase an aggregate of 1,544,983 shares of preferred stock will adjust into common stock warrants.

#### ***JOBS Act***

We are an “emerging growth company,” as defined in the Jumpstart Our Business Startups Act, or JOBS Act. Under the JOBS Act, 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 new or revised accounting standards that have different transition dates for public and private companies until those standards would otherwise apply to private companies. We have elected to use this extended transition period. As a result of this election, our timeline to comply with these standards will in many cases be delayed as compared to other public companies that are not eligible to take advantage of this election or have not made this election. Therefore, our financial statements may not be comparable to those of companies that comply with the public company effective dates for these standards.

For so long as we are an emerging growth company we expect that:

- we will present only two years of audited consolidated financial statements, plus unaudited consolidated condensed financial statements for any interim period, and related management's discussion and analysis of financial condition and results of operations in our initial registration statement;
- we will avail ourselves of the exemption from the requirement to obtain an attestation and report from our auditors on the assessment of our internal control over financial reporting pursuant to the Sarbanes-Oxley Act;
- we will avail ourselves of the extended transition periods available to emerging growth companies under the JOBS Act for complying with new or revised accounting standards; and
- we will provide less extensive disclosure about our executive compensation arrangements.

We will remain an emerging growth company for up to five years, although we will cease to be an "emerging growth company" upon the earliest of: (1) the last day of the fiscal year following the fifth anniversary of this offering, (2) the last day of the first fiscal year in which our annual revenues are \$1.07 billion or more, (3) the date on which we have, during the previous rolling three-year period, issued more than \$1.0 billion in non-convertible debt securities, and (4) the date on which we are deemed to be a "large accelerated filer" as defined in the Exchange Act.

#### **Recent Accounting Pronouncements**

See Note 2 to our consolidated financial statements included elsewhere in this prospectus for information concerning recent accounting pronouncements.

#### **Quantitative and Qualitative Disclosures about Market Risk**

The market risk inherent in our financial instruments and in our financial position represents the potential loss arising from adverse changes in interest rates. As of June 30, 2018, we had \$7.6 million in cash and cash equivalents, consisting of non-interest and interest-bearing bank accounts. Our primary exposure to market risk is interest rate sensitivity, which is affected by changes in the general level of U.S. interest rates. Due to the short-term, low-risk profile of our bank accounts, an immediate 100 basis point change in interest rates would not have a material effect on the fair market value of our cash equivalents.

#### **Internal Control Over Financial Reporting**

Pursuant to Section 404(a) of the Sarbanes-Oxley Act, commencing the year following our first annual report required to be filed with the SEC, our management will be required to report on the effectiveness of our internal control over financial reporting. To comply with the requirements of being a reporting company under the Exchange Act, we will need to implement additional financial and management controls, reporting systems and procedures and hire additional accounting and finance staff, as well as potentially upgrade our information technology systems.

## BUSINESS

### Overview

We are a life sciences instrumentation company in the genome analysis space. We develop and market the Saphyr system, a platform for ultra-sensitive and ultra-specific structural variation detection that enables researchers and clinicians to accelerate the search for new diagnostics and therapeutic targets and to streamline the study of changes in chromosomes, which is known as cytogenetics. Our Saphyr system comprises an instrument, chip consumables, reagents and a suite of data analysis tools.

Structural variation refers to large-scale structural differences in the genomic DNA of one individual compared to another. Each structural variation involves the rearrangement or repetition of as few as hundreds to as many as tens of millions of DNA base pairs. Those rearrangements may be insertions, deletions, duplications, inversions or translocations of segments of one or more chromosomes. Structural variations may be inherited or arise spontaneously, and many cause genetic disorders and diseases. Until our commercial launch of the Saphyr system in February 2017, and since, we believe no products existed or exist that could more comprehensively and cost and time-efficiently detect structural variation.

Our Saphyr system comprises an instrument, chip consumables, reagents and a suite of data analysis tools. Our customers include researchers and clinicians who seek to uncover and understand the biological or clinical impact of genome variation to improve the diagnosis and treatment of patients with better clinical tests and new medicines or to replace existing cytogenetic tests that are expensive, slow and labor-intensive, with a modern solution that simplifies workflow and reduces costs and that has the potential to significantly increase diagnostic yields across the industry. Our customers also include researchers in non-human segments such as agricultural genomics where they seek to advance their understanding of how structural variation impacts industrial applications of plants and animals. We have established relationships with key opinion leaders in genomics research and clinical applications, including rare diseases and oncology, and our installed base of over 90 systems made up of Saphyr and its predecessor system includes some of the world's most prominent clinical, translational research, basic research, academic and government institutions as well as leading pharmaceutical and diagnostic companies. Examples include Children's National Health System, DuPont Pioneer, Garvan Institute of Medical Research, Genentech, Icahn School of Medicine at Mount Sinai, McDonnell Genome Institute at Washington University, National Institutes of Health, Pennsylvania State University and Salk Institute for Biological Studies. Our revenues in 2017 were \$9.5 million, representing approximately 40% growth over the prior year, and for the first half of 2018 our revenues were \$5.2 million, representing approximately 32% growth over the prior year comparable period. Our cumulative revenues for the period from January 1, 2016 through June 30, 2018 from each of the customers listed above were, respectively, \$0.5M, \$0.5M, \$0.3M, \$0.3M, \$0.1M, \$0.4M, \$0.1M, \$0.3M, and \$0.1M.

Approximately 6,000 research use only, or RUO, high throughput sequencers are currently installed worldwide. These sequencers are developed and sold almost entirely by Illumina and are owned by an estimated 3,000 unique customers. Sequencing is very good at detecting genome differences involving just a few base pairs or single-nucleotide variations, which Saphyr cannot detect, but sequencing including next-generation sequencing, or NGS, cannot reliably detect the larger structural variations that our Saphyr system can detect. Therefore, Saphyr is being adopted alongside this installed base of sequencers as a complement that gives users the ability to see a much wider scope of genome variation than ever before.

The Saphyr system, which is for RUO, is also beginning to be adopted by cytogenetics labs that seek to use it in commercial clinical tests of its patients as an LDT. These labs currently rely on existing methods such as karyotyping, fluorescence in situ hybridization, or FISH, and microarrays for clinical tests and research that look at chromosomal structure, location and function in cells. Major guidelines for oncology and genetic disease clinical diagnostics recommend first-line structural variation testing by these existing methods. The organizations issuing these guidelines include, among many others, World Health Organization (WHO), National

Comprehensive Cancer Network (NCCN), American College of Medical Genetics (ACMG) and American College of Obstetricians & Gynecologists (ACOG).

Saphyr and its predecessor system, which we collectively refer to as our system in this prospectus, have been cited by researchers and clinicians in approximately 130 publications covering structural variations in areas of high unmet medical need and research interest, such as rare and undiagnosed pediatric diseases, muscular diseases, developmental delays and disorders, prostate cancer and leukemia. Importantly, Saphyr can be used alone to provide comprehensive detection of structural variations and enable diagnostic calls without the need for any sequencing or cytogenetic technology.

## **Industry Background**

Genome analysis is the process of extracting biological information from DNA. DNA is the code that is found in all living cells and determines the characteristics and health of all living organisms. Although each organism's DNA order is unique, all DNA is composed of the same four nucleotides that come in pairs, which are referred to as base pairs. The human genome is composed of six billion of these base pairs (three billion of which are the maternal copy and three billion of which are the paternal copy of the genome), distributed across 23 pairs of chromosomes ranging in size from approximately 50 million to approximately 250 million base pairs. Genome variation is defined as at least one base pair differing in a comparison of sequence against a reference standard and can be as large as tens of millions of base pairs.

It had long been believed by the scientific community that all problems in genome analysis could be addressed by DNA sequencing, which is a method of determining the precise order of the bases adenine (A), guanine (G), cytosine (C) and thymine (T) in a genome. Many in the industry felt that the only bottlenecks for sequencing companies to address were the cost per genome and the throughput of the sequencers. If these issues could be addressed, it was generally believed that sequencing would usher in a new wave of medical-grade genome analysis that would give rise to an abundance of highly impactful discoveries in medicine. These discoveries would lead to novel therapies and patient management pathways driven by exquisitely specific and sensitive diagnostic tests.

In recent years, however, it has become evident that sequencing is not completely fulfilling the needs of researchers and clinicians. For example, after 10 years with next-generation sequencing in use, the diagnostic yields of the leading genetic testing laboratories in the world continue to hover around only 50%, which is where they have been for at least two decades, meaning that only half of patients receive a confirmed pathogenic diagnosis. Researchers and clinicians now agree that despite major advances in the speed and cost-effectiveness of sequencing, it fails to reliably detect structural variations, which represent an entire class of genome variation.

Structural variation is one of the most biologically important aspects of the human genome. It is the underlying driver of many known human diseases, including numerous genetic disorders, inherited diseases and cancer. Structural variations occur when relatively large groups of base pairs change their existence or position in the genome relative to a normal standard. Structural variations can be as small as a few hundred base pairs or as large as tens of millions of base pairs and can be confined to one chromosome or can unfold between chromosomes. The changes can be rearrangements in location, order or orientation, and they can involve the insertion, deletion or duplication of entire blocks of base pairs. As an example of the importance of structural variations, thousands of base pairs can be rearranged and result in the ABL gene from one chromosome joining the BCR gene on an entirely different chromosome to form BCR-ABL, an oncogenic fusion gene which causes certain leukemias.

We believe the available methods to detect structural variations for research and clinical applications, other than Saphyr, are antiquated and cumbersome and can only detect a small proportion of the structural variations across an entire genome. These methods therefore have very limited utility in population research studies that seek to discover new structural variations to explain pathology. Without additional tools, researchers and

clinicians cannot comprehensively study the genome, which will ultimately result in the failure of genomics to deliver on its full promise of new therapies and diagnostics.

The Saphyr system provides a solution for comprehensive structural variation analysis. The Saphyr system is a proprietary, sample-to-result platform based on physical mapping of the genome, which is the process of assigning the chromosomal location, order and orientation of the functional elements of the genome. We believe that Saphyr is the only product capable of detecting structural variations at high sensitivity and specificity with a workflow that is cost-effective and time-efficient. A complete and accurate physical map of the genome enables the user to much more readily and systematically detect the structural variations that sequencing and cytogenetics technologies miss. Our mapping makes it possible for researchers and clinicians to more comprehensively detect structural variations and measure the complete scope of genome variation present in their study populations.

### Market Opportunity

According to Research and Markets, the worldwide market for genomics products and services is expected to reach approximately \$23.9 billion by 2022, up from approximately \$14.7 billion in 2017, representing a compound annual growth rate of 10.2%. We believe that the market opportunity is predominantly split among three regions: North America, Europe and Asia. Within Asia, one of the fastest growing genomics markets is China, where adoption of genome analysis technology has been growing at approximately 20% per year.

The two segments of the genomics market that are driving the uptake of our product are:

- **Sequencing for Discovery Research.** In discovery research across patient cohorts, sequencing is primarily used to find single nucleotide variations responsible for disease or therapeutic response. Sequencing alone, however, is significantly limited due to its inability to reveal structural variations. Our Saphyr system has been expanding this market segment by complementing sequencing to expand the scope of genome variation that can be analyzed in a study and achieve a more comprehensive view of the genome.
- **Cytogenetics.** To provide a clinical diagnosis, cytogenetic tests detect known variations that are linked to specific diseases or therapeutic responses. The technologies used for detecting structural variations are expensive and involve cumbersome workflows with relatively limited ability to scale to higher volumes or more complex testing panels. Sequencers tend not to be used for cytogenetics due to their inability to reliably detect structural variations. Cytogenetics laboratories are beginning to adopt Saphyr as a more effective and efficient approach to finding the structural variations relevant to cytogenetics. For this segment, Saphyr is used alone to provide comprehensive detection of structural variations and enable diagnostic calls without the need for any sequencing or cytogenetic technology.

We believe that the discovery research and cytogenetics segments together comprise an addressable opportunity for us to sell up to approximately 8,500 Saphyr systems, representing a current total instrument market opportunity of approximately \$2.1 billion. Importantly, we expect this market opportunity to expand at the rate of adoption of new RUO high throughput sequencers which we estimate is over 15% per year. While we do not expect the number of cytogenetics labs to increase significantly, we do expect our growth in this market to be driven by conversion of traditional cytogenetics methodologies to our Saphyr system.

In addition to the instrument sales opportunity, Saphyr instruments generate recurring revenue from chip consumables that are used on a per-sample basis. We believe each Saphyr instrument has the potential to create recurring revenue in a range of approximately \$75,000 to approximately \$150,000 per year, suggesting a potential annual recurring revenue opportunity of approximately \$0.6 billion to approximately \$1.3 billion.

Therefore, we believe that our currently addressable portion of the genome analysis market is estimated to be between \$2.7 billion and \$3.4 billion.

## **Existing Technologies and Their Limitations**

Existing technologies fail to adequately address the need for structural variation detection because they do not overcome the inherent complexity of the genome or they are not capable of providing a cost-effective, scalable solution to meet the increasing demands of genomics research and clinical applications.

### ***The Genome Is Complex***

Genome composition itself makes the measurement of genome structure and structural variation inherently difficult. Genome sequence is built from combinations of only the A, G, C and T nucleotides. The nucleotides have a natural pairing system in which A pairs with T and G pairs with C. Each pair of nucleotides is referred to as a base pair. In humans, the approximately six billion base pairs are distributed across 23 pairs of chromosomes. A chromosome is an organizational unit that biology has evolved to compartmentalize genomic information. One set of 23 chromosomes (three billion base pairs) is inherited from each parent. Within each chromosome, the base pairs are organized into functional elements such as genes, which code for protein production, and other elements that regulate how and when the genes are expressed for protein production.

The six billion base pairs that make up the human genome cannot be read by any existing technology in a simple linear, contiguous fashion. Due in part to only four unique nucleotides being available to write the entire genetic code, it is very common for stretches of sequence to be identical either within the same chromosome or between chromosomes. As much as two-thirds of the human genome is made up of repetitive DNA sequences. This repetition tends to cause structural variations to be flanked by sequences that are identical to sequences in other parts of the genome which further complicates structural variation detection.

### ***The Genome Orchestrates Life and Genome Structure Is Key***

Genome structure is the way in which the functional elements are organized. Namely, the location on each chromosome where the gene or functional regulatory elements are found, what order and orientation they are in and how many of each element are present. This organization is an essential part of the instructions that the organism uses in every one of its cells to develop and differentiate and to react and respond to its environment over its lifetime. When this critical location, order, orientation or quantity vary, it is termed structural variation.

Even though both single nucleotide variation and structural variation are each very common, a much larger number of variant nucleotides in the average human genome are found in structural variations as compared to single nucleotide variations. A recent study showed that 30 million base pairs, on average, in the human genome are part of structural variations while only 10 million are single nucleotide variations. Most variations are inconsequential and make up the background variation responsible for the diversity of life. Over time, these variations can randomly affect genes and proteins which, through natural selection, drive diversity and evolution across species and diversity within them. Variations can also cause disease.

Relative to single nucleotide variations, structural variations are much more apt to be profoundly disruptive. They often cause a tectonic shift in the genome. These genomic shifts can have devastating effects on the health of a human. Examples where structural variations caused a disruption of genes resulting in disease include:

- dystrophin gene variation – structural variation disrupting dystrophin production that is found in Duchenne Muscular Dystrophy;
- 9pminus variation – deletion found in a rare developmental syndrome in children;
- TMPRSS2-ERG fusion – gene fusion found in prostate cancer;
- EML4-ALK fusion – gene fusion found in lung cancer; and
- BCR-ABL fusion (Philadelphia chromosome) – gene fusion found in leukemias such as chronic myelogenous leukemia, acute lymphoblastic leukemia and acute myelogenous leukemia.

It is important to detect these structural variations and the potentially thousands of other structural variations in each individual. Sequencing and cytogenetics simply do not elucidate comprehensive structural variations in a systematic and cost- and time-efficient manner. Most structural variations found to date that have been implicated in disease, such as those listed above, were discovered through laborious, expensive, unindustrialized and non-comprehensive methods over the course of many years. Thousands of additional important structural variations are believed to exist and are expected to be found with a systematic structural variation detection tool such as our Saphyr.

### ***The Limitations of Sequencing***

As the first complete draft of the human genome was being assembled in 2000, the belief arose that most questions in genome analysis could be addressed by sequencing. Over the course of over 15 years, sequencing proliferated across the entire genome analysis community with Illumina becoming the clear sequencing industry leader. As more sequencing data emerged, it became apparent that sequencing alone would not adequately elucidate the causes of human disease. The promise of sequencing was not fully delivered due to sequencing's inability to address the complexities of genome composition.

Nearly all genome sequencing, including next-generation sequencing, uses a method called sequencing by synthesis. Sequencing by synthesis is an in-vitro process for synthesizing a copy of DNA, one base at a time in a way that makes it possible to measure the identity of each base as it is incorporated into the growing DNA copy. Sequencing by synthesis involves cutting genomic DNA into small pieces of a few hundred base pairs each, amplifying these pieces many times and anchoring them to a solid support where they are copied by a polymerase using fluorescently labeled bases. These copies are called sequencing reads. Illumina, which is the world leader in next-generation sequencing technology, markets systems that provide average read lengths that are 100 to 300 base pairs long. These short reads are matched by computer programs to a reference genome in a process called alignment. The reference is meant to represent the "standard" human genome in a normal, non-diseased state. It is the result of billions of dollars spent on the Human Genome Project and other initiatives begun in the late 1990s and early 2000s to put together the first complete set of human DNA code. When a patient's genome is sequenced today, the short reads are compared against the reference as a template. Using this approach, sequencing attempts to reconstruct, or "resequence," the genome and infer genome variations.

The read lengths typical for next-generation sequencing are often too short to determine the right location and orientation of a reading frame in the genome because many of the reads from one chromosome are identical to reads from either another chromosome or even another location on the same chromosome. When reads are indistinguishable from one another, computations cannot be performed to place the reads in the correct location in the genome.

The other significant limitation with next-generation sequencing is that the genome fragments used as templates in the copying process are also very short. This fragmentation is a result of the methods used for DNA isolation from the cell and the use of polymerase chain reaction, or PCR. These short lengths disconnect and destroy most of the structural information of the original genome and make next-generation sequencing unable to reliably detect genomic variations larger than a few hundred base pairs.

If the sequencing reads were accurate, on the order of hundreds of thousands of base pairs long and from templates that were even longer, they would overcome the redundancy of genome composition and every read would have a unique position in the genome. It would then be possible to assemble a structurally accurate picture of the genome. Accurate structural variation would be revealed upon comparing structurally accurate assemblies of genomes across a population to determine the structural changes that are driving the observed pathology or physiology.

The recognition of the need for greater lengths of sequence reads to determine genome structure, birthed the so-called long-read sequencing submarket. Because of the need for long-read sequencing, Pacific Biosciences of

California developed a system that uses another alternative form of sequencing by synthesis, while Oxford Nanopore Technologies developed a system that uses nanopore technology. These systems provide users with average read lengths in the tens of thousands of base pairs. However, these read lengths have proven not to be long enough to reliably and comprehensively detect structural variations. Pacific Biosciences' polymerases cannot regularly produce reads that are the necessary hundreds of thousands of base pairs in length. In addition, Oxford Nanopore's system has difficulty reliably feeding molecules that are, on average, hundreds of thousands of base pairs in length through each nanopore. The time and cost of providing a comprehensive whole genome analysis of a patient in a clinical setting is prohibitive when using these longer-read technologies.

In summary, all existing sequencing technologies, whether short or long, do not provide a solution for integrating structural variation into patient diagnosis and management.

### ***The Limitations of Cytogenetics***

Cytogenetics is the study of chromosomal structure and how structural variations impact health. The field has historically relied on karyotyping, FISH and more recently, microarrays. These methods each can detect some structural variations, but they are all inadequate solutions for high volume and low cost genetic testing for structural variations and none is an approach that can comprehensively detect structural variations with the ultra-high sensitivity and ultra-high specificity of the Saphyr system.

#### *Karyotyping*

Karyotyping is the gross optical examination of the chromosomes using a microscope. It is a laboratory technique, modernized in the 1960s, whereby the chromosomes from one cell are stained and visualized by a pathologist or technician to investigate the total number and structure of chromosomes.

Karyotyping has many limitations. It is cell culture dependent and therefore requires live and actively dividing cells. Karyotyping has extremely low resolution and is therefore only sensitive for very large structural variations that are unambiguous to identify. Given that chromosomes are being directly viewed on a slide by a pathologist with a microscope, resolution tends to be limited to structural events that are larger than five million base pairs. When karyotyping is used to diagnose unknown genetic disease, only about 5% of karyotyping tests result in a confirmed pathogenic finding. The test is costly, and its results are subject to each pathologist's interpretation which introduces variability in diagnostic calls and makes the methodology not amenable to automation.

#### *FISH*

FISH is a molecular cytogenetic technique that is used to detect chromosomal aberrations. FISH is based on the idea of using a specifically developed probe to detect a particular gene abnormality that is suspected to be in the genome. When the probe finds targeted variation, it binds to it and generates a fluorescent signal which is observed with a fluorescence microscope.

Several characteristics of FISH limit its productivity and efficiency for use in structural variation detection. Like karyotyping, it is cell culture dependent and therefore requires live and actively dividing cells. Also, FISH is limited to known targets and cannot be used for discovery. Every FISH test performed needs to be chosen to look for a specific genetic marker that the clinician anticipates may be found based on the clinical symptoms of the patient. In addition, the test results can be ambiguous and inconclusive, and reproducibility and variability among users can be a significant issue. Like karyotyping, FISH's diagnostic yield is very low when used to diagnose unknown genetic disease with only an estimated 7% of FISH providing a confirmed pathogenic finding. In addition, FISH is expensive, especially for the limited amount of information that it provides.



*Microarrays*

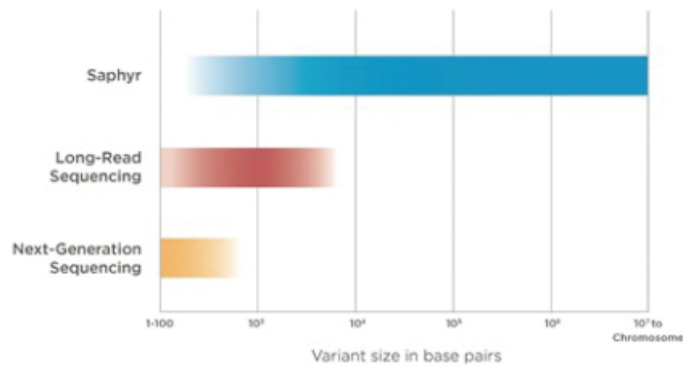
Chromosomal microarrays and SNP (single nucleotide polymorphism) arrays are tests consisting of slides that contain thousands of spots of DNA fragments that bind to the DNA of the sample. Microarrays detect gains and losses of specifically chosen DNA sequence and can also infer gene expression levels. Microarrays interrogate thousands of genes simultaneously that are known to be associated with presumed genetic disorders of interest to the user. Probe coverage is typically highly focused in regions of known clinical significance.

Microarrays have limited utility as a diagnostic tool as they are only useful when there are gains and losses of base pairs within the sample's genome that are specific to the probes that are populated on the array. Microarrays are also limited in their ability to provide specific locations of gains or losses on a chromosome, or even identify on which chromosome that the gains or losses occur. In addition, microarrays have low resolution as they cannot reliably detect structural variants smaller than 50,000 base pairs. Also, the diagnostic yield of microarrays is low. Only an estimated 20% of microarray tests provide a confirmed pathogenic finding when used to diagnose unknown genetic disease.

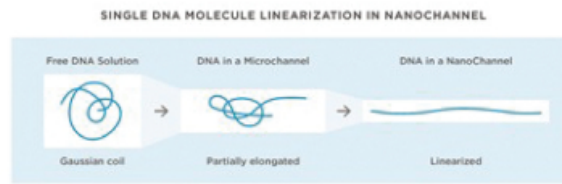
**Our Solution**

Our approach to measuring genome structure and structural variation is novel and highly differentiated. Most efforts in the genomic industry to address structural variation have been based on taking sequencing by synthesis as the starting point and attempting to overcome its deficiencies to make it applicable to structural variation analysis. In contrast, the Saphyr system directly observes extremely long genomic DNA without any amplification to construct a physical map that accurately assigns the chromosomal location, order, orientation and quantity of all the genome's functional elements. Our solution is built upon four key elements:

- **Extremely long molecules for analysis.** Structural accuracy can only come from analysis of extremely long chromosomal fragments. The Saphyr system is capable of analyzing single molecules that are on average approximately 250,000 base pairs long. Such fragments will contain enough unique sequence information that they are distinguishable from other fragments. These lengths are over 1,000 times longer than the average read length with Illumina systems and approximately 10 times longer than the average read lengths with Pacific Biosciences and Oxford Nanopore systems. Building a picture of the genome with massive building blocks overcomes the inherent challenge of genome complexity and is the key to Saphyr's unprecedented sensitivity and specificity.



- **Proprietary nanotechnology for massively parallel linearization and analysis of long molecules with single molecule imaging.** Analyzing these extremely long chromosomal fragments required invention. Molecules of this size are more like balls of yarn in a test tube and must be unraveled for meaningful analysis. We invented, patented, developed and commercialized nanochannel arrays to capture them from solution and unwind and linearize them for structural variation analysis. Each molecule is imaged separately, making it possible to deconvolute complex mixtures including haplotypes and heterogeneous tumors, as shown in the graphic below.



- **DNA labeling chemistry specifically for physical mapping.** The detailed analysis of sequence we use is also highly unique and novel. Instead of identifying the sequence of every base pair in these long fragments, we label and detect specific sequence patterns or motifs that occur universally across every genome with an average frequency of approximately one site for every few thousand base pairs. The key to our method entails introducing fluorescent tags at the sequence-specific site using highly specific and robust enzymatic chemistry along the extremely long fragments. These fragments, stretched out in nanochannels, are then directly imaged allowing us to measure the distance between labels with high accuracy. The pattern of labels detected on all these fragments can then be related to the pattern of sequence motif sites in a reference genome for comparison. Changes in the pattern indicate structural variation.
- **Bioinformatic tools for structural variation analysis.** Finally, our approach includes a novel bioinformatics platform that we developed from the ground-up to take advantage of the unique benefits of our solution. It comprises proprietary algorithms for the construction of a structurally accurate physical map of the genome without using a reference genome in assignment of structure. Physical maps of a test subject are then compared in cross-mapping analysis that allows our system to detect genome wide structural variation, including the most complex balanced events. Our system can do so by comparing one physical map against a common reference, or against the maps of a mother and father in the case of an afflicted child with an undiagnosed disease for example, or against maps of normal blood when studying solid tumor cancers. This comparative approach uses our proprietary database of healthy individuals to filter out the non-disease causing structural variants found in the general healthy population.

#### **Our Focus Areas**

Our Saphyr system serves many segments of the genomics market seeking to find and understand structural variation. We have identified focus areas where we concentrate our resources to ensure robust adoption of our system and frequent utilization of consumables. We have selected these segments because of their urgent need to detect structural variations and the significant economic opportunity they represent. Our current focus areas are human genetic diseases, including rare diseases and oncology. Our Saphyr system, which is for RUO, is being used for basic and translational research and also beginning to be adopted by cytogenetics labs that seek to use it in commercial clinical tests of its patients as an LDT.

#### **Rare Diseases**

In genetic disease, existing tools have reached a plateau where almost half of patients with genetic disease who are tested in clinical laboratories fail to receive a molecular diagnosis. In order to increase diagnostic yield, a

massive increase in the understanding of the complete structure and variation of the genome is essential. We believe the various studies presented below illustrate how Saphyr is essential to achieving this objective.

*Example: Undiagnosed Diseases Network Patient*

The National Institutes of Health funded Undiagnosed Diseases Network, or UDN, brings together top clinical and genomics teams from several key institutes in the U.S. to study the most difficult to diagnose genetic disease patients. Through a collaboration with UCLA, Dr. Eric Vilain of Children's National Medical Center runs all UDN patients of the UCLA cohort on Saphyr to identify pathogenic variants that go undetected using sequencing or cytogenetics in known or novel genes.

While data collection and a full analysis of the cohort is ongoing, at the American Society of Human Genetics, or ASHG, annual meeting, Dr. Vilain's team presented preliminary results on the first 12 UDN patients and their parents analyzed with Saphyr. In each family, Saphyr detected thousands of variants of which more than 100 were rare, and typically three to seven structural variations that were new to the patient, referred to as de novo structural variations, were identified. In one case presented at ASHG, whole genome sequencing and chromosomal microarray on the DNA of a girl with developmental delay, autism, poor sleep and self-mutilation failed to identify pathogenic variants. Saphyr was able to detect a 2,500-base pair insertion inherited from the father in a gene where whole genome sequencing had picked up a random mutation inherited from the mother. Together, the two variants create a compound heterozygous mutation in a gene with a known phenotype that includes poor sleep, developmental delay and autism with self-mutilation. Large heterozygous insertions like the one presented here are seldomly detected by next-generation sequencing and are too small for microarrays. The diagnosis of this patient was only possible by the combination of next-generation sequencing and Saphyr.

Based on Dr. Vilain's results, including a study on patients with Duchenne Muscular Dystrophy published in *Genome Medicine*, Saphyr targets the 40% to 70% of genetics patients who cannot be diagnosed with exome or whole genome sequencing. Saphyr has the power to replace multiple tests for genetic disorders, including microarrays, PCR tests and chromosomal cytogenetic tests. Each existing test requires a patient to visit a clinician and most often provides an inconclusive result. Dr. Vilain showed evidence that integration of Saphyr into existing diagnostic regimens can help to change the way that medicine is practiced.

*Example: Rare Familial Cancer*

A rare cancer, occurring in approximately one in one million people, was found in four members of a single extended family. A team at MD Anderson Cancer Center had used all standard clinical tools and whole genome sequencing on the affected family members but failed to identify any causative variants. Using Saphyr data, a 38,000-base pair sequence was found in these patients in six tandem copies, while unaffected family members had a single copy of this sequence. The duplication was found to be upstream of an important gene in the pathway known to be upregulated in this rare cancer. The identification of this mutation could be useful for pre-implantation embryo analysis and targeted treatments.

*Example: Repeat Expansion Disorder*

In a study by Dr. Eric Wang of the University of Florida, Saphyr was able to precisely count the number of times that a sequence segment was repeated in muscle cells derived from a patient with Myotonic Dystrophy. This devastating disease is a repeat expansion disorder, caused by the extreme lengthening of short repeat array in the genome. Other diseases in this category include ALS, Huntington's Disease, and Fragile-X disease. Current methods that do not utilize our Saphyr system cannot measure the length of such repeat arrays accurately. Saphyr's ability to measure the normal and expanded repeat with unprecedented accuracy and detail on single molecules could help allow the development of better targeted tests and medicines.

*Example: Greenwood Genetic Center*

Greenwood Genetic Center, based in South Carolina, has acquired Saphyr as part of a project to increase the diagnostic yield for patients with genetic disorders and cancer. As one of the first centers in the world to introduce next-generation sequencing in a diagnostic setting, Greenwood Genetic Center aims to introduce a lab developed test, or LDT, based on Saphyr. As such, a number of patients with a variety of birth defects and developmental disorders are being analyzed on Saphyr.

In genetic disease, the standard of care consists usually of a combination of both phenotype-dependent targeted tests, and whole-genome analysis approaches. Targeted tests can consist of Multiple Ligation Probe Amplification, or MLPA, to test for the presence or absence of specific exons, PCR amplification and Sanger sequencing of candidate genes and multiple FISH probes to pick up specific structural variants common to the expected disease. For whole genome approaches, first tier diagnostic tools include karyotyping techniques like metaphase chromosome spreads and in some cases microarrays. More recently, whole exome sequencing or whole genome sequencing are increasingly being introduced.

A future workflow in which Saphyr replaces the large majority of FISH and MLPA tests for a genetics clinic such as Greenwood Genetic Center would rely on Saphyr to detect all structural variants larger than 500 base pairs, and on next-generation sequencing to detect all single nucleotide variants and other variants smaller than 500 base pairs. Since up to numerous FISH and MLPA tests are often performed, Saphyr's single whole genome analysis provides a cost effective solution that saves significant amounts of time, labor and analysis in lieu of such tests.

**Oncology**

In cancer, each patient has a unique disease with a complex pattern of genome changes. Traditional and recently-developed treatments do not attack the individual changes in each patient's tumor. Recent personalized medicine programs aim to provide clinicians with individual treatments specifically targeting the mutations found in each patient's cancer. For personalized cancer medicine to be successful, all variants in the cancer genome need to be detected, which is not feasible with cytogenetic or whole genome sequencing approaches. The studies presented below demonstrate that Saphyr is critical for a complete understanding of a cancer genome, which is essential to enable truly targeted treatments.

*Example: Hematologic Malignancies*

In a study to be published in Nature Genetics, Dr. James Broach, Director of the Penn State Institute for Personalized Medicine, presented system's ability to detect large rearrangements in leukemia, with a strong focus on translocations. In his research, our system detected all known translocations identified with standard clinical tools and, importantly, many structural variations never before identified in cancer, plus hundreds of structural variations that could not be seen by other methodologies.

Attempts by Dr. Broach to detect translocations using next-generation sequencing were unsuccessful because of the large number of false positive translocation calls. Because of the highly repetitive nature of the human genome, many remote genomic regions have high sequence homology, and short-read sequencing often fails to correctly map reads to the correct genomic origin, leading to excessive false positive calls. The extremely long molecules that our system analyzes span long repetitive segments of sequence and can anchor sequences into the correct genomic context, leading to extremely few false positive calls.

Given the high speed, low cost, industry-leading sensitivity and high reliability of our system displayed in this study, Dr. Broach showed evidence that our system is well positioned to eventually become the primary tool for clinical detection of genomic structural variation.

*Example: Prostate Cancer*

In a study published in *Oncotarget*, Dr. Vanessa Hayes at the Garvan Institute of Medical Research in Australia presented a complete tumor-normal comparison from a primary prostate cancer. Dr. Hayes' team identified 85 large somatic deletions and insertions, of which half directly impact potentially oncogenic genes or regions. Only 11% of these large structural variations were detected using high-coverage, short-read next-generation sequencing and bioinformatics analyses using a combination of the leading structural variation calling algorithms for next-generation sequencing data. Many structural variations detected with our system were flanked by repetitive sequences, making them undetectable to short-read sequencing.

In subsequent studies presented at the Advances in Genome Biology and Technology annual meeting, Dr. Hayes detected several oncogenic driver mutations in metastasized prostate cancer samples. Several of the reported mutations were variants previously found in other cancer types but never before reported in prostate cancer, and for which effective treatments are available. Existing gene panels or FISH tests performed on cancer samples only test for expected variants. Our system's whole genome analysis approach is the only molecular method that is capable of identifying all major structural variants in a cancer genome with sufficiently high sensitivity. To make existing targeted cancer therapies more effective and to discover new ones, a complete characterization of the genome is important, making our system valuable in personalized cancer medicine.

**Our Products**



We develop and market the Saphyr system, a complete sample-to-result solution for structural variation analysis that empowers comprehensive genome analysis and facilitates a deeper understanding of genetic variation and function. We believe it is the only solution capable of addressing the needs for structural variation analysis because it is:

- **Highly sensitive.** We believe Saphyr is the most sensitive structural variation detector currently on the market in that it can identify structural variations that no other system can.
- **Highly specific.** The structural variations found by Saphyr are found by direct observation rather than inference. Saphyr has a very low false positive rate, typically less than 2%.
- **Cost effective.** We anticipate that the Saphyr users' cost per sample will reach \$500 in 2018, which would represent one-tenth of what it was in 2014. We expect this cost per sample to continue to decline to less than \$300 per sample in 2019 and less than \$100 per sample in 2020.
- **Fast.** Saphyr generates greater than 640 giga base pairs of information per day, on par with some of the faster short-read sequencers in the market. For highly sensitive structural variation detection, this allows Saphyr to process two human samples per day. We expect Saphyr's throughput to increase to six per day by the middle of 2019 and 12 per day by the end of 2020. Over this same period, we expect to continuously improve the automation of sample prep and bioinformatics to help drive efficiencies of workflow.

Saphyr is being adopted across an extensive base of customers in world-class clinical, translational research, basic research, academic and governmental institutions as well as pharmaceutical and biotechnology companies. We began marketing the Saphyr system in February 2017 after previously marketing Irys, our first-generation system, which was a slower system. We sell through a direct sales force and support organizations in North America and Europe, and through distribution partners in the Asia-Pacific and other regions of the world. We have sold more than 90 of our systems to over 80 customers globally. We continually seek to expand our product offerings to meet the needs of our customers.

When customers adopt the Saphyr system, they acquire one or more instruments, chips, reagents for DNA isolation and labeling and a suite of bioinformatics tools. The chips and reagents are used on a recurring basis. We also sell them ancillary solutions such as servers, reagents and other non-proprietary components used with the system. We designed Saphyr to accommodate performance upgrades without the need for replacement of the entire instrument. We intend for these performance enhancements to be delivered through software upgrades, purchased hardware upgrades and new chips and reagents.

### ***The Saphyr Instrument***



The Saphyr instrument is a single-molecule imager that includes high performance optics, automated sample loading based on machine learning algorithms and computational hardware and control software. The instrument's high-performance optics simultaneously image DNA linearized in hundreds of thousands of nanochannels. The instrument's control interface is the user's primary control center to design and monitor experiments as they occur in real time. The computational hardware is responsible for the secondary processing of the image data being produced on the Saphyr.

The Saphyr instrument currently analyzes one Saphyr chip, containing up to two samples, per day with statistically relevant depth of coverage across each whole genome. An upgrade of the capability of the Saphyr instrument to process two chips, instead of one, per run is planned for the middle of 2019. This instrument upgrade along with the planned improvements to the chip mentioned below will enable Saphyr to process up to six human samples per day by the middle of 2019 and 12 per day by the end of 2020.

### ***The Saphyr Chip***



The Saphyr chip is the consumable that packages the nanochannel arrays for use in genome analysis. In its current form, each Saphyr chip has two flow cells. Each flow cell contains approximately 120,000 nanochannels that are roughly 50 nanometers wide and can hold a unique sample, which enables a researcher to analyze two samples per chip per day. We plan to offer a new chip to our customers in the middle of 2019 that will have three flow cells which, combined with the instrument upgrade mentioned above, will allow Saphyr to process six human samples per day. In 2020, we expect to offer a 12-flow cell version of the chip. The instrument at that time will be able to run two chips per run; however, given the increased processing load of the 12-flow cell chip relative to the three-flow cell chip, Saphyr is expected to take two days to process two 12-flow cell chips, thereby enabling a throughput of 12 samples per day in 2020.

To manufacture the arrays, we use photolithography in a semiconductor fabrication facility to print hundreds of thousands of tiny grooves on silicon wafers and then dice the wafers into individual chips. Our chips are inexpensive to manufacture and highly scalable. The fluidic environment in each channel allows individual molecules to move swiftly utilizing only the charge of DNA. Our nanochannels allow only a single linearized molecule at a time to enter a given channel while preventing the molecule from tangling or folding back on itself. Importantly, hundreds of thousands of molecules can move through hundreds of thousands of parallel nanochannels simultaneously, enabling extremely high-throughput processing on a single-molecule basis.

### ***Saphyr Sample Prep and Labeling Kits***



Our Bionano Prep Kits™ and labeling kits provide the critical reagents and protocols needed to extract and label high molecular weight, or HMW, DNA for use with the Saphyr™ system. These kits are optimized for performing our genome mapping applications on a variety of sample types.

Our workflow begins with the isolation of ultra-high molecular weight DNA. Our sample prep kits are optimized for isolating and purifying ultra-high molecular weight DNA in a process that is gentler than existing DNA extraction methods. The resulting purified DNA is millions of base pairs long and optimal for use with our systems. Each Bionano Prep Kit allows customers to perform five to 10 HMW DNA preps. Our kits and protocols enable the extraction of HMW DNA from a variety of sample types including soft or fibrous animal tissue, plant tissue, cell lines and human blood.

Our labeling reagents are optimized for applications on our genome mapping systems. Starting with HMW DNA purified using the appropriate Bionano Prep Kit, fluorescent labels are attached to specific sequence motifs. The result is uniquely identifiable genome-specific label patterns that enable de novo map assembly, anchoring sequencing contigs and discovery of structural variations as small as 500 base pairs to up to chromosome arm lengths.

Our newest and most powerful kit for DNA labeling, the Direct Label and Stain, or DLS, Kit is a proprietary, nondestructive chemistry for sequence motif labeling of genomic DNA that improves every aspect of our genome mapping. DLS uses a single direct-labeling enzymatic reaction to attach a fluorophore to the DNA at a specific 6-base pair sequence motif, yielding approximately 16 labels per 100,000 base pairs in the human genome. After labeling, the molecules are linearized in the Saphyr chip on the Saphyr instrument and imaged. Through the isolation, labeling and linearization steps, the molecules maintain an average length of around 250,000 base pairs. The label patterns on each molecule allow them to be uniquely identified and aligned in a pair-wise comparison against all other molecules imaged from the same sample.

## Data Solutions



Our data solutions offering includes a complete suite of hardware and software for end-to-end experiment management, algorithms for assembling genome maps and algorithms and databases for bioinformatics processing, all of which is driven through convenient web-based management and monitoring tools.

Bionano Access is our web-based hub for Saphyr operations. It provides all the software that our customers need for experiment management and our structural variation analysis in one place. With Bionano Access our customers can:

- set up runs and monitor real-time data quality metrics remotely to flag potential sample quality issues early;
- automatically start de novo assemblies and structural variation analysis when the desired amount of data has been collected;
- visualize and manipulate maps and structural variants; and
- analyze trios and clinical samples by filtering through uncommon variants to identify inherited and de novo variants, and export in a file format that is used consistently throughout the industry.

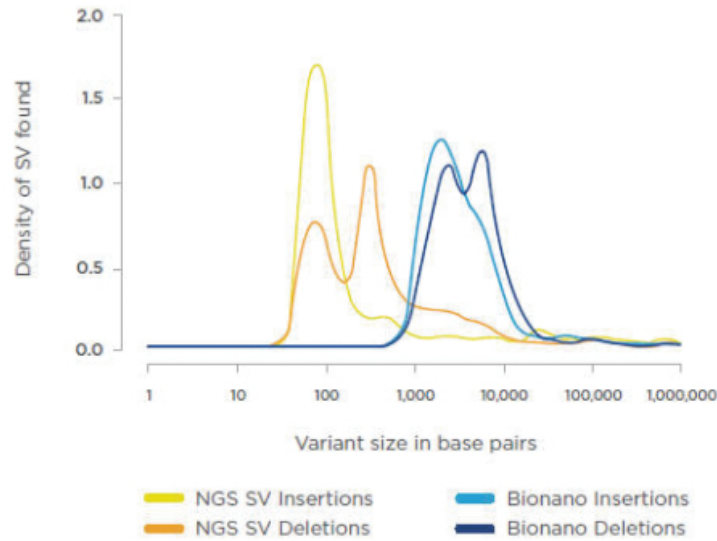
We have a suite of proprietary algorithms and databases that fully enable our proprietary bioinformatic and structural variation analysis pipelines. Using pairwise alignment of the single molecule images, consensus genome maps are constructed, refined, extended and merged. Molecules are then clustered into two alleles, and a diploid assembly is created to allow for heterozygous structural variation detection. Genome maps typically span entire chromosome arms in single, contiguous maps. Comparative analysis of maps reveals structural variation. Our customers use our variant annotation workflow to specifically uncover rare and sample-specific mutations. For example, to help a customer determine genomic variant frequency in a tumor, Saphyr compares the cancer sample structural calls against over 600,000 structural variations from over 160 humans with no evidence of diseases. To identify somatic mutations, the workflow can run comparisons of the tumor specimen against a control sample to determine whether the cancer mutations are present in low abundance among the control's genome. Using this high through-put pipeline approach we can efficiently focus on dozens of clinically significant structural candidates for further analysis.

Our hardware solution includes the Saphyr Compute Server, which provides offers cluster-like performance in an affordable, compact solution and the Bionano Compute Server, which expands the analytical capacity of the suite of tools. With these solutions, our customers are capable of performing multiple simultaneous analyses and sustaining continuous throughput, which allows them to spend less time waiting for data, so they can focus on investigating results. We also offer a cloud-based solution for data analysis through a third party provider and expect to launch our own cloud-based solution by the fourth quarter of 2018.



**The Saphyr System’s Industry-Leading Sensitivity and Specificity**

Our Saphyr system detects structural variations that Illumina’s systems miss. As shown in the graphic below, the Garvan Institute of Medical Research generated data that we expect to be published which shows the density of structural variations found relative to the size of the structural variation found for our system (blue lines) against next-generation sequencing (Illumina; orange lines). Next-generation sequencing has a very significant deficiency in detecting structural variations. Given our system’s ability to detect structural variations, it picks up essentially where next-generation sequencing drops off, as shown below.



Retaining long-range contiguity throughout the genome mapping process is critical for any comprehensive study of genome structure and function, particularly for the analysis of structural variation in complex genomes. Saphyr offers unmatched sensitivity for the detection of large structural variations greater than 500 base pairs. Saphyr’s specific sensitivity percentages from recent studies are shown below:

- 99% sensitivity for homozygous insertions/deletions larger than 500 base pairs;
- 95% sensitivity for heterozygous insertions/deletions larger than 500 base pairs;
- 95% sensitivity for balanced and unbalanced translocations larger than 50,000 base pairs;
- 99% sensitivity for inversions larger than 30,000 base pairs;
- 97% sensitivity for duplications larger than 30,000 base pairs; and
- 97% sensitivity for copy number variants larger than 500,000 base pairs.

A study of Pacific Biosciences’ long-read sequencing’s ability to detect homozygous and heterozygous insertions and deletions was published recently. The sensitivity to detect homozygous structural variations using Pacific Biosciences was 87%, compared to 99% using Saphyr. The sensitivity to detect heterozygous structural variations using Pacific Biosciences was only 41%, which is less than half the 84% sensitivity for heterozygous structural variation detection using Saphyr. Even when the Pacific Biosciences structural variation calls were

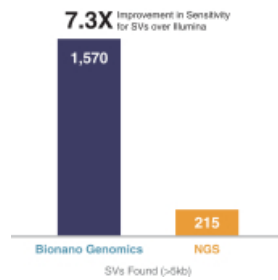
limited to insertions and deletions larger than 500 base pairs, the sensitivity for homozygous structural variations was only 81%, and for heterozygous structural variations was only 49%.

SV Sensitivity		
	Bionano Genomics	Pacific Biosciences
Insertions		
Homozygous	99.3%	80.4%
Heterozygous	81.2%	39.7%
Deletions		
Homozygous	98.8%	82.4%
Heterozygous	87.9%	62.0%

\*Sensitivity for variations >500 base pairs

Saphyr detects duplications over 30,000 base pairs, in direct or inverse orientation, with a sensitivity of 97%. Saphyr detects 99% of inversions of that same size range. Inversions are the invisible variants and have traditionally been the hardest to detect structural events. They are balanced, without gain or loss of sequence, and unlike translocations they do not create easily visible changes in genomic context. Inversions often escape detection by traditional cytogenetic techniques. Chromosomal microarrays cannot identify balanced events, and metaphase chromosome spreads can only visualize some megabase-size inversions. Next-generation sequencing approaches tend to miss inversions because reads from inside the inversion tend to map back to the reference without any indication that the orientation of the sequence has changed. Detection of the breakpoints often fails, especially if the inversion is flanked by segmental duplications, repeat sequences or other non-unique sequences. Saphyr’s imaging of extremely long molecules overcomes these obstacles to identifying inversions.

In a separate study, our system detected seven times more structural variations larger than 5,000 base pairs compared to next-generation sequencing. Dr. Pui-Yan Kwok at the University of California, San Francisco, demonstrated the robustness of our system for genome-wide discovery of structural variations in a trio from the 1000 Genomes Project. Using our system, hundreds of insertions, deletions, and inversions greater than 5,000 base pairs were uncovered amounting to 7.3 times more than the large structural variation events detected by next-generation sequencing. Importantly, many of the structural variations that were found were in regions believed to contain functional elements leading to disruption of gene function or regulation.



**Our Strengths**

We have established ourselves as one of the leaders in the field of genome analysis, and we believe we are the industry’s performance leader in structural variation detection. Below are our strengths that we believe will

enable us to capture a significant portion of the genome analysis market and retain our leadership position in structural variation:

- **Highly differentiated technology platform enables researchers and clinicians to obtain information that cannot be had systematically and cost efficiently from traditional technologies.** Saphyr's unique ability to systematically and cost efficiently see structural variations across the genome from 500 base pairs to tens of millions of base pairs is unique in the industry. We believe this greater insight will facilitate a paradigm shift in healthcare from an emphasis on treatment with relatively untargeted therapies to a focus on earlier detection, more precise diagnosis and treatment with better targeted therapies.
- **Validated solution recognized industry-wide.** We have deep and expanding scientific validation. Our system has been cited in approximately 130 publications, and we believe our technology is becoming a vital tool in cutting-edge life sciences research.
- **Strong installed base of premier customers.** We have sold more than 90 of our systems to over 80 customers globally. Our customers include some of the world's most prominent clinical, translational research, basic research, academic and government institutions as well as leading pharmaceutical and diagnostic companies. Examples include Children's National Health System, DuPont Pioneer, Garvan Institute of Medical Research, Genentech, Icahn School of Medicine at Mount Sinai, McDonnell Genome Institute at Washington University, National Cancer Institute, National Institutes of Health, Pennsylvania State University and Salk Institute for Biological Studies.
- **Attractive business model with a growing, high-margin recurring revenue component.** As we continue to grow our installed base of Saphyr systems, optimize workflows and expand our structural variation detection capabilities, we expect to rapidly increase our high-margin revenues derived from consumables. The successful integration of our technology into our customers' projects provides ongoing sales of assays and consumables.
- **Industry-leading intellectual property portfolio.** We have developed a global patent portfolio that includes 43 issued patents across 14 patent families and an exclusively licensed portfolio of patents and applications from Princeton University, which includes 22 patents across two families. This global patent portfolio has filing dates ranging from 2001 to 2017. We have robust intellectual property protection surrounding our devices, systems, and methods for macromolecular analysis. Our ideation stems from our highly active research programs and results in our patent portfolio continually expanding at a significant pace.
- **Highly experienced senior management team.** We are led by a dedicated and highly experienced senior management team with significant industry experience and proven ability to develop novel solutions. Each of the members of our senior management has more than 20 years of relevant experience.

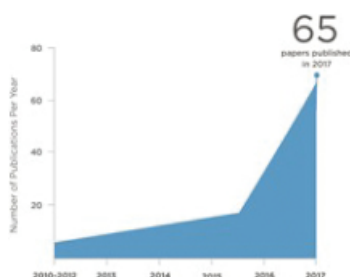
## Our Strategy

Our goal is to enable new research in genomics to allow greater insight into their role in human health in ways that have not been possible with any other current research and diagnostic technologies.

Our strategy to achieve this includes:

- **Drive adoption of Saphyr in discovery research and cytogenetics markets.** Saphyr has the potential to significantly expand the life science research market and genomics-based diagnostics market because of its unrivaled sensitivity, by enabling researchers to perform studies on structural variations that they were previously unable to perform. We believe Saphyr has the capability to enable the development of a new category of diagnostic tests and tools.
- **Support the publication of findings with Saphyr by our customers beyond the over 130 papers published to date.** The chart below shows the annual number of publications released since 2010 which

featured data generated by Saphyr and its predecessor system. Recently, the overall number of these publications has grown significantly. For example, of the over 130 papers published to date, approximately half were published in 2017 alone. We will continue to support and foster our customer base to help grow the number of publications featuring our systems' data. We believe that these publications are impactful as our customers' studies cover structural variations in areas of high unmet medical need, such as rare and undiagnosed pediatric diseases, muscular diseases, developmental delays and disorders, prostate cancer and leukemia.



- **Expand gross margins through economies of scale and growing sales of consumables.** Our overall gross margin has historically been driven by our instrument gross margin as the sales of our instruments have constituted the vast majority of our total revenues to date. Our instrument gross margin is significantly lower than our consumables gross margin. We expect our overall gross margin to expand in 2018 and beyond as:
  - We further negotiate with silicon fabrication manufacturers for better contract pricing of our consumables. As our manufacturing lot volumes increase, we expect to have lower costs of goods sold. This is driven by the pass along of some of the economies of scale of contract manufacturers that mainly operate in the ultra-high-volume silicon computer chip industry.
  - Consumables sales continue to represent the fastest growing component of overall revenues. As consumables growth continues to outpace instrument growth, we expect the proportion of our product mix which is higher gross margin to increase, thereby expanding our overall gross margin.
- **Continue to innovate our products and technologies.** We designed Saphyr to accommodate performance enhancements without the need for replacement of the entire instrument. For example, hardware upgrades and new consumables are made available to purchase by customers. We intend for these performance enhancements to be delivered on a regular basis. In addition, we periodically make available software upgrades to customers through download at no charge. We will continue to develop and refine our technologies to improve the ease of use of our Saphyr system and enable our existing installed systems to meaningfully increase sample throughput and sensitivity and specificity of structural variation detection.
- **Partner with industry-leading companies and laboratories to accelerate adoption in clinical markets.** Establish additional collaborations with customers to help drive validating studies. Expand partnership efforts with clinical diagnostic companies to commercialize LDTs in the U.S. as well as LDTs and approved tests outside the U.S.

## Sales and Marketing

Our commercial team includes 16 individuals, including seven salespeople, two marketing personnel, and seven sales support personnel, including customer solutions personnel, field specialists and application specialists.

This commercial staff is primarily located in North America and Europe. Most of our sales support team is located at our headquarters in San Diego and some work remotely throughout the U.S., Europe and China.

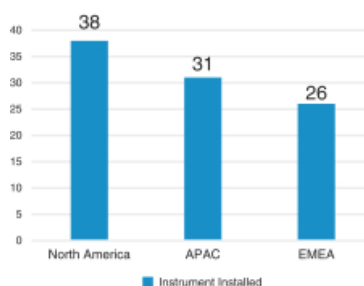
We sell our products through a direct sales force in North America and Europe. Our sales strategy involves the use of a combination of sales managers, sales representatives and field application specialists. Our direct sales force includes four salespeople located in the U.S. and three located in Europe. We expect to increase our sales force as we expand our business.

We sell our products through a network of distributors in the Asia-Pacific region and select other markets outside of North America and Europe. Specifically, we distribute our instruments and reagents via third-party distributors in markets such as China, Japan, South Korea, Singapore, Australia, India and South Africa. Four of our distributors are in China, one in Australia, one in Japan and one in South Korea.

The role of our sales managers and sales representatives is to educate customers on the advantages of Saphyr and the applications that our system makes possible. The role of our field application specialists is to provide on-site training and scientific technical support to prospective and existing customers. Our field application specialists are technical experts with advanced degrees, including four with Ph.D.s, and generally have extensive experience in academic research and core sequencing lab experience.

In addition, we maintain an applications lab team in San Diego, California composed of scientific experts who can transfer knowledge from the research and development team to the field application specialists. The applications lab team also runs foundational scientific collaborations and proof of principle studies, which help demonstrate the value of our product offering to prospective customers.

Our domestic and international sales force informs our current and potential customers of current product offerings, new product and new assay introductions, and technological advances in Saphyr systems, workflows, and notable research being performed by our customers or ourselves. As our primary point of contact in the marketplace, our sales force focuses on delivering a consistent marketing message and high level of customer service, while also attempting to help us better understand evolving market and customer needs.



We intend to significantly expand our sales, support, and marketing efforts in the future by expanding our direct footprint in North America and Europe as well as developing a more comprehensive support network in China where significant market opportunities exist. Additionally, we believe that there is significant opportunity in other European, South American, Asia-Pacific and Middle Eastern regions. We plan to expand into these regions via initial penetration with distributors.

Our sales and marketing efforts are targeted at key opinion leaders, laboratory directors and principal investigators at leading translational research, clinical institutions, governmental research institutions and pharmaceutical companies. In addition to our selling activities, we align with key opinion leaders at leading institutions and clinical research laboratories to help increase scientific and commercial awareness of our

technology, demonstrate its benefits relative to existing technologies and accelerate its adoption. We also seek to increase awareness of our products through participation at trade shows, academic conferences, online webinars and dedicated scientific events attended by prominent users and prospective customers.

Our systems are relatively new to the life science marketplace and require a capital investment by our customers. The sales process typically involves numerous interactions and demonstrations with multiple people within an organization. Some potential customers conduct in-depth evaluations of the system including having us run experiments on in-house Saphyr systems. In addition, in most countries, sales to academic or governmental institutions require participation in a tender process involving preparation of extensive documentation and a lengthy review process. Because of these factors and the budget cycles of our customers, our sales cycle, the time from initial contact with a customer to our receipt of a purchase order, can often be nine to 12 months.

### **Manufacturing and Supply**

Our manufacturing strategy is to outsource instrument and chip manufacturing and internally develop and assemble reagent kits in our own facility.

### ***Instruments***

Our Saphyr instrument is manufactured by a third party medical device manufacturer. Nearly complete Saphyr instruments are shipped by the manufacturer to us for final assembly and quality control testing. Upon completion, we ship directly to our customers' locations globally, or distributors' locations in the case of certain systems sold in the Asia-Pacific region. Installation of, and training on, our products is provided by our employees in the markets where we conduct direct sales, and by distributors in those markets where we operate with distributors.

We believe this manufacturing strategy is efficient and conserves capital. However, in the event it becomes necessary to utilize a different contract manufacturer for Saphyr, we would experience additional costs, delays and difficulties in doing so, and our business could be harmed.

This manufacturer actively manages obsolescence of all components in our system. This is done through their supply management process where we get notified of any parts that will become obsolete with enough lead time to identify alternatives.

### ***Consumables***

All of our chip consumables are produced by a third party manufacturer at its facility; however, we have established procedures for a replacement manufacturer if required. We complete final assembly and quality control assessments of our chips at our headquarters in San Diego.

Our reagents are sourced from a limited number of suppliers, including certain single source suppliers. Reagents include all components required to run a sample on Saphyr, such as capture and detector reagents, enzyme reagents and enzyme substrate. Although we believe that alternatives would be available, it would take time to identify and validate replacement reagents for our assay kits, which could negatively affect our ability to supply assay kits on a timely basis. Reagents are supplied through a single source supplier. This supplier requires a sufficient notification period to allow for supply continuity and the identification and technology transfer to a new supplier in the event either party wishes to terminate the relationship.

We actively manage component obsolescence by subscribing to our vendors' end-of-life notifications. If a vendor is unable to provide sufficient notification, we keep safety stock of the component to minimize disruption to operations.

## **Key Agreements**

### ***License Agreement with Princeton University***

In January 2004, we entered into a license agreement, or the License Agreement, with Princeton University, or Princeton. Pursuant to the License Agreement, we received a worldwide, exclusive right and license to, among other things, manufacture and market products or services utilizing patents and inventions related to our sample preparation, DNA imaging and genomic data analysis platform and other key technology.

We are obligated to pay Princeton an annual license maintenance fee in the mid-four digits, which can be reduced by royalties paid to Princeton during the preceding 12 month period. We are also obligated to make royalty payments to Princeton equal to (i) a percentage in the mid-single digits of our and any of our sub-licensees' net sales of products covered by the License Agreement and (ii) a percentage in the low-single digits of our and any of our sub-licensees' revenue from services covered by the License Agreement. Our royalty obligations continue on a licensed product-by-licensed product and licensed service-by-licensed service basis, in every country of the world, until the later of the last sale of a licensed product or service or the expiration of all Princeton patent rights.

The term of the License Agreement will continue until all of our royalty payment obligations have expired, unless terminated earlier. Princeton may terminate the License Agreement upon written notice in the event of our material breach of the License Agreement if such breach remains uncured for 60 days. We may terminate the License Agreement without cause upon 60 days' advance written notice to Princeton.

### ***Agreement for the Manufacture of Our Instruments***

We have engaged a single third party manufacturer to produce and test our instruments on an as-ordered basis. The manufacturer of our instruments has no obligation to manufacture our instruments without a purchase order. In addition, this manufacturer has no obligation to maintain inventory in excess of any open purchase orders or materials in excess of the amount it reasonably determines will be consumed within 90 days. We are obligated to purchase any material deemed in excess pursuant to the agreement. The price we pay is determined according to a mutually agreed-upon pricing formula. We may terminate a purchase order by giving the manufacturer at least 30 days' written notice.

### ***Agreement for the Manufacture of Our Chip Consumables***

We have engaged a single third party manufacturer to manufacture our chip consumables used in our Saphyr system and provide engineering services to us. This third party has no obligation to manufacture our chip consumables without a purchase order. The prices and fees we pay are established in our agreement with this manufacturer or determined by the manufacturer pursuant if supported by appropriate information. Our agreement with this manufacturer automatically renews for successive one year terms unless a party notifies the other party in writing at least 30 days prior to the expiration of the then-current term. We may terminate an order of the agreement at any time upon 30 days' written notice.

### ***Berry Genomics Agreement***

We have entered into a collaboration agreement, or the Berry Agreement, with Berry Genomics Co., Ltd, or Berry. Under the terms of the Berry Agreement, Berry agreed to develop, market and commercialize a Berry-branded in-vitro diagnostic, or IVD, system (which is comprised of both kits and instruments) in the People's Republic of China, or the PRC, in certain specified fields, as well as for clinical use by its partners. Pursuant to the Berry Agreement, Berry agreed to purchase certain of our components for use exclusively within the kits and instruments that make up the IVD system. Berry is then responsible for manufacturing the finished system, as well as for obtaining regulatory approvals for the sale of our components in the PRC. Per the Berry Agreement, we are obligated to provide the necessary support and documentation for the components, as well as provide training to enable Berry's after-sales installation and support for the IVD system.

Pursuant to the terms of the Berry Agreement, we granted to Berry and its affiliates, an irrevocable, exclusive, sublicensable, fully paid-up, royalty-free, license during the term of the agreement, solely to seek and obtain CFDA registration, manufacture, market, distribute and sell IVD kits and IVD instruments. We also have the right to all IVD system improvements. We have the first right, but not obligation, to take any measures we deem appropriate to enforce our intellectual property rights. We also agree to provide reasonable assistance related to such enforcement actions as Berry may request at the cost and expenses of Berry.

The Berry Agreement may be renewed by either party upon 90 days written notice and subject to the negotiation of an agreement facilitating such renewal. Either party may terminate the agreement for a material breach if such breach remains uncured for 30 days, or immediately if the breach is not curable. We may also immediately terminate the Berry Agreement if Berry fails to fulfill its minimum quantity purchase requirements.

### **Intellectual Property**

Our core technology for nucleic acid research is related to methods and devices for non-sequencing based analysis of macromolecules such as nucleic acids. Using this technology, long (high-molecular weight) nucleic acids can be suitably labeled and elongated in order to ascertain structural information such as scaffold organization, copy number, and de novo analysis of genomic repeats that is not readily obtained with current sequencing-based approaches. We have secured and continue to pursue intellectual property rights globally, including rights related to analysis of nucleic acid molecules, as well as innovations in the molecular biology and bioinformatics spaces.

We have developed a global patent portfolio that includes 43 issued patents across 14 patent families and an exclusively licensed portfolio of patents and applications from Princeton University, which includes 22 patents across two families. This global patent portfolio has filing dates ranging from 2001 to 2017. The owned and licensed families contain issued patents and pending applications that relate to devices, systems, and methods for macromolecular analysis, and reflect our active and ongoing research programs. The commercial foci of these patent families are discussed below.

<u>Commercial Focus</u>	<u>Number of Issued and Pending Patents</u>
Nanochannel devices and systems	70
Methods of macromolecule analysis using nanochannel arrays	62
Methods of genetic detection and copy number analysis	28
Method of genomic sequence and epigenomic analysis.	48
Biomolecule isolation and processing for use in nanochannel analysis	3
Method of optimizing nanochannel analysis	6
Next-generation products	11

In addition to pursuing patents, we have taken steps to protect our intellectual property and proprietary technology by entering into confidentiality agreements and intellectual property assignment agreements with our employees, consultants, corporate partners and, as applicable, our advisors.

### **Government Regulation**

Our products are currently intended for research use only, or RUO, applications, although our customers may use our products to develop their own products that are subject to regulation by the FDA. Although most products intended for RUO are not currently subject to clearance or approval by the FDA, RUO products fall under the FDA's jurisdiction if they are used for clinical rather than research purposes. Consequently, our products are labeled "For Research Use Only."



The FDA's 2013 Guidance for Industry and Food and Drug Administration Staff on "Distribution of In Vitro Diagnostic Products Labeled for Research Use Only or Investigational Use Only," or, the RUO/IUO Guidance, provides the FDA's thinking on when IVD products are properly labeled for RUO or for IUO. The RUO/IUO Guidance explains that the FDA will review the totality of the circumstances when evaluating whether equipment and testing components are properly labeled as RUO. Merely including a labeling statement that a product is intended for research use only will not necessarily exempt the device from the FDA's 510(k) clearance, premarket approval, or other requirements, if the circumstances surrounding the distribution of the product indicate that the manufacturer intends its product to be used for clinical diagnostic use. These circumstances may include written or verbal marketing claims or links to articles regarding a product's performance in clinical applications, a manufacturer's provision of technical support for clinical validation or clinical applications, or solicitation of business from clinical laboratories, all of which could be considered evidence of intended uses that conflict with RUO labeling.

When marketed for clinical diagnostic use, our products will be regulated by the FDA as medical devices. The FDA defines a medical device in part as an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article which is intended for the diagnosis of disease or other conditions or in the cure, mitigation, treatment, or prevention of disease in man. FDA regulates the development, testing, manufacturing, marketing, post-market surveillance, distribution, advertising and labeling of medical devices requires them to be register by the medical device manufacturer and listed as marketed products.

The FDA classifies medical devices into one of three classes on the basis of the intended use of the device, the risk associated with the use of the device for that indication, as determined by the FDA, and on the controls deemed by the FDA to be necessary to reasonably ensure their safety and effectiveness. Class I devices, which have the lowest level of risk associated with them, are subject to general controls. Class II devices are subject to general controls and special controls, including performance standards. Class III devices, which have the highest level of risk associated with them, are subject to general controls and premarket approval. Most Class I devices and some Class II devices are exempt from a requirement that the manufacturer submit a premarket notification, or 510(k), and receive clearance from the FDA which is otherwise a premarketing requirement for a Class II device. Class III devices may not be commercialized until a premarket approval application, or PMA, is submitted to and approved by the FDA.

#### ***510(k) Clearance Pathway***

To obtain 510(k) clearance, a sponsor must submit to the FDA a premarket notification demonstrating that the device is substantially equivalent, or SE, to a device legally marketed in the U.S. for which a PMA was not required. The FDA is supposed to make a SE determination within 90 days of FDA's receipt of the 510(k), but it often takes longer if the FDA requests additional information. Most 510(k)s do not require supporting data from clinical trials, but the FDA may request such data.

#### ***Premarket Approval Pathway***

A PMA must be submitted if a new device cannot be cleared through the 510(k) process. The PMA process is generally more complex, costly and time consuming than the 510(k) process. A PMA must be supported by extensive data including, but not limited to, technical, preclinical, clinical trials, manufacturing and labeling to demonstrate to the FDA's satisfaction the safety and effectiveness of the device for its intended use. After a PMA is sufficiently complete, the FDA will accept the application for filing and begin an in-depth review of the submitted information. By statute, the FDA has 180 days to review the accepted application, although, review of the application generally can take between one and three years. During this review period, the FDA may request additional information or clarification of information already provided. Also during the review period, an advisory panel of experts from outside the FDA may be convened to review and evaluate the application and provide recommendations to the FDA as to the approvability of the device. In addition, the FDA will conduct a preapproval inspection of the manufacturing facility to ensure compliance with its quality system regulations, or

QSRs. New premarket approval applications or premarket approval application supplements are also required for product modifications that affect the safety and efficacy of the device.

### **Clinical Trials**

Clinical trials are usually required to support a PMA and are sometimes required for a 510(k). In the U.S., if the device is determined to present a “significant risk,” the manufacturer may not begin a clinical trial until it submits an investigational device exemption application, or IDE, and obtains approval of the IDE from the FDA. These clinical trials are also subject to the review, approval and oversight of an institutional review board, or IRB, at each clinical trial site. The clinical trials must be conducted in accordance with the FDA’s IDE regulations and good clinical practices. A clinical trial may be suspended by FDA, the sponsor or an IRB at its institution at any time for various reasons, including a belief that the risks to the study participants outweigh the benefits of participation in the trial. Even if a clinical trial is completed, the results may not demonstrate the safety and efficacy of a device to the satisfaction of the FDA, or may be equivocal or otherwise not be sufficient to obtain approval of a device.

After a medical device is placed on the market, numerous regulatory requirements apply. These include among other things:

- compliance with QSRs, which require manufacturers to follow stringent design, testing, control, documentation, record maintenance, including maintenance of complaint and related investigation files, and other quality assurance controls during the manufacturing process;
- reporting of device malfunctions, serious injuries or deaths;
- registration of the establishments where the devices are produced;
- labeling regulations, which prohibit the promotion of products for uncleared or unapproved uses; and
- medical device reporting obligations, which require that manufacturers investigate and report to the FDA adverse events, including deaths, or serious injuries that may have been or were caused by a medical device and malfunctions in the device that would likely cause or contribute to a death or serious injury if it were to recur.

Failure to comply with applicable regulatory requirements can result in enforcement action by the FDA, which may include sanctions, including but not limited to, warning letters; fines, injunctions, and civil penalties; recall or seizure of the device; operating restrictions, partial suspension or total shutdown of production; refusal to grant 510(k) clearance or PMA approvals of new devices; withdrawal of 510(k) clearance or PMA approvals; and civil or criminal prosecution. To ensure compliance with regulatory requirements, medical device manufacturers are subject to market surveillance and periodic, pre-scheduled and unannounced inspections by the FDA.

Laboratories that purchase certain of our products and perform clinical diagnostic testing are also subject to extensive regulation under the Clinical Laboratory Improvement Amendments of 1988, or CLIA, requiring clinical laboratories to meet specified standards in areas such as personnel qualifications, administration, participation in proficiency testing, patient test management, quality control, quality assurance and inspections. Adverse interpretations of current CLIA regulations or future changes in CLIA regulations could have an adverse effect on sales of any affected products. Moreover, if we decide to operate our own clinical testing laboratory, we will be required to comply with CLIA. If, in the future, we operate our own clinical laboratory to perform clinical diagnostic testing, we would become subject to the Health Insurance Portability and Accountability Act of 1996, or HIPAA, as well as additional federal and state laws that impose a variety of fraud and abuse prohibitions on healthcare providers, including clinical laboratories.

### ***Laboratory Developed Tests***

Although the FDA has statutory authority to regulate medical devices, the FDA has historically exercised its enforcement discretion and not enforced applicable provisions of the FDC Act and FDA regulations with respect to laboratory developed tests, or LDTs, which are a subset of in vitro diagnostic tests that are intended for clinical use and designed, manufactured and used entirely within a single laboratory. The FDA does not consider devices to be LDTs if they are designed or manufactured completely, or partly, outside of the laboratory that offers and uses them. We sell our Saphyr system on an RUO basis to CLIA certified cytogenetics laboratories, which may use the system to develop LDTs.

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 draft guidance that sets forth a proposed risk-based regulatory framework that would apply such oversight to LDTs. The FDA has indicated that it does not intend to implement its proposed framework until the draft guidance documents are finalized. 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. A significant change in the way that the FDA regulates any LDTs that we, our collaborators or our customers develop using our technology could affect our business. If the FDA requires laboratories to undergo premarket review and comply with other applicable FDA requirements in the future, the cost and time required to commercialize an LDT will increase substantially, and may reduce the financial incentive for laboratories to develop LDTs, which could reduce demand for our instruments and our other products. In addition, if the FDA were to change the way that it regulates LDTs to require that we undergo pre-market review or comply with other applicable FDA requirements before we can sell our instruments or our other products to clinical cytogenetics laboratories, our ability to sell our instruments and other products to this addressable market would be delayed, thereby impeding our ability to penetrate this market and generate revenue from sales of our instruments and our other products.

### ***Europe/Rest of World Government Regulation***

Whether or not we obtain FDA approval for a product, we must obtain the requisite approvals from regulatory authorities in non-U.S. countries prior to the commencement of clinical trials or marketing of our product for clinical diagnostic use in those countries. The regulations in other jurisdictions vary from those in the U.S. and may be easier or more difficult to satisfy and are subject to change. For example, the European Union recently published new regulations that will result in greater regulation of medical devices and IVDs. The IVD Regulation is significantly different from the IVD Directive that it replaces in that it will ensure that the new requirements apply uniformly and on the same schedule across the member states, include a risk-based classification system and increase the requirements for conformity assessment. The conformity assessment process results in the receipt of a CE designation which has been sufficient to begin marketing many types of IVDs. That process will become more difficult and costly to complete.

### ***Other Governmental Regulation***

We are subject to laws and regulations related to the protection of the environment, the health and safety of employees and the handling, transportation and disposal of medical specimens, infectious and hazardous waste and radioactive materials. For example, the U.S. Occupational Safety and Health Administration, has established extensive requirements relating specifically to workplace safety for healthcare employers in the U.S. This includes requirements to develop and implement multi-faceted programs to protect workers from exposure to blood-borne pathogens, including preventing or minimizing any exposure through needle stick injuries. For purposes of transportation, some biological materials and laboratory supplies are classified as hazardous materials and are subject to regulation by one or more of the following agencies: the U.S. Department of Transportation, the U.S. Public Health Service, the U.S. Postal Service and the International Air Transport Association. We generally use third-party vendors to dispose of regulated medical waste, hazardous waste and radioactive materials that we may use during our research.

### ***Coverage and Reimbursement***

Currently, our product is for research use only, but clinical laboratories may acquire our instrumentation through a capital purchase or capital lease and use the Saphyr and direct label stain chemistry to create their own potentially reimbursable products, such as laboratory developed tests for in vitro diagnostics. Our customers may generate revenue for these testing services by seeking the necessary approval of their product from the FDA or the Center for Medicare and Medicaid Services, or CMS, along with coverage and reimbursement from third-party payors, including government health programs and private health plans. The ability of our customers to commercialize diagnostic tests based on our technology will depend in part on the extent to which coverage and reimbursement for these tests will be available from such third-party payors.

In the U.S., molecular testing laboratories have multiple options for reimbursement coding, but we expect that the primary codes used will be the genomic sequencing procedure codes, or GSPs. The American Medical Association, or AMA, added GSPs to its clinical laboratory fee schedule in 2015. In addition, CMS recently issued a coverage determination providing for the reimbursement of next-generation sequencing for certain cancer diagnostics using an FDA-approved in vitro diagnostic test. Private health plans often follow CMS to a substantial degree, and it is difficult to predict what CMS will decide with respect to reimbursement of any products our customers try to commercialize.

In Europe, coverage for molecular diagnostic testing is varied. Countries with statutory health insurance (e.g., Germany, France, The Netherlands) tend to be more progressive in technology adoption with favorable reimbursement for molecular diagnostic testing. In countries such as the United Kingdom with tax-based insurance, adoption and reimbursement for molecular diagnostic testing is not uniform and is influenced by local budgets.

Ultimately, coverage and reimbursement of new products is uncertain, and whether laboratories that use our instruments to develop their own products will attain coverage and adequate reimbursement is unknown. In the U.S., there is no uniform policy for determining coverage and reimbursement. Coverage can differ from payor to payor, and the process for determining whether a payor will provide coverage may be separate from the process for setting the reimbursement rate. In addition, the U.S. government, state legislatures and foreign governments have shown significant interest in implementing cost containment programs to limit the growth of government-paid health care costs, including price controls and restrictions on reimbursement.

### ***Healthcare Reform***

In the U.S. and abroad, there have been and continue to be a number of legislative initiatives to contain healthcare costs and change the way healthcare is financed. By way of example, in March 2010, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Affordability Reconciliation Act, collectively, the ACA, became law. The ACA is a sweeping law intended to broaden access to health insurance, reduce or constrain the growth of healthcare spending, enhance remedies against fraud and abuse, add new transparency requirements for the healthcare and health insurance industries, impose new taxes and fees on the health industry and impose additional health policy reforms. The ACA's provisions of importance to our business include, but are not limited to, a 2.3% excise tax on certain entities that manufactures or imports medical devices offered for sale in the U.S., which has been suspended, but due to subsequent legislative amendments, will be automatically reinstated for medical device sales beginning January 1, 2020, unless Congress takes additional action to delay the implementation of the tax.

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 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 or otherwise circumvent some of the requirements for health insurance mandated by 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, two bills affecting the implementation of certain taxes under the ACA have been signed into law. The 2017 U.S. Tax Cuts and Jobs Act includes a provision repealing, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on certain individuals who fail to maintain qualifying health coverage for all or part of a year that is commonly referred to as the “individual mandate”. Additionally, a 2018 continuing resolution on appropriations delays the implementation of certain ACA-mandated fees, including, without limitation, the medical device excise tax.

Further, other legislative changes have been proposed and adopted since the ACA was enacted. For example, on April 1, 2014, the Protecting Access to Medicare Act of 2014, or PAMA, was signed into law, which, among other things, significantly altered the payment methodology under the Medicare Clinical Laboratory Fee Schedule, or CLFS. PAMA requires certain laboratories performing clinical diagnostic laboratory tests to report to CMS the amounts paid by private payors for laboratory tests. Beginning on January 1, 2018, CMS has begun using reported private payor pricing to periodically revise payment rates under the CLFS.

We expect that additional state and federal healthcare reform measures will be adopted in the future, any of which could limit the amounts that federal and state governments will pay for healthcare products and services. In addition, sales of our tests outside of the U.S. will subject us to foreign regulatory requirements, which may also change over time.

#### ***Other Healthcare Laws***

Our operations are directly or indirectly, through our customers, subject to various federal and state fraud and abuse laws, including, without limitation, the federal and state anti-kickback statutes and false claims laws. These laws may impact, among other things, our sales and marketing and education programs, and our financial and business relationships with researchers who use our instruments to develop marketed products. By way of example: the federal Anti-Kickback Statute prohibits, among other things, any person or entity from, among other things, knowingly and willfully soliciting, receiving, offering or paying any remuneration, directly or indirectly, to induce, or in return for, purchasing, leasing, ordering, or arranging for or recommending the purchase, lease, or order of any good, facility, item, or service reimbursable, in whole or in part, under a federal healthcare program; and the federal false claims laws, including, without limitation the federal civil False Claims Act, prohibit, among other things, anyone from knowingly and willingly presenting, or causing to be presented for payment, to the federal government (including Medicare and Medicaid) claims for reimbursement for, among other things, drugs or services that are false or fraudulent, claims for items or services not provided as claimed, or claims for medically unnecessary items or services. The ACA, among other things, amended the intent requirement of the federal Anti-Kickback Statute to clarify that 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 crime. In addition, the ACA clarifies that the government may assert that a claim that includes items or service resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the federal civil False Claims Act.

In addition, we may be subject to HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act and its implementing regulations, which imposes certain requirements relating to the privacy, security and transmission of individually identifiable health information without appropriate authorization by entities subject to the rule, such as health plans, health care clearinghouses and certain health care providers and their business associates who create, use or disclose HIPAA protected health information on their behalf. We may also be subject to state and foreign laws that govern the privacy and security of health information in some circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

If our operations are found to be in violation of any of these laws, we may be subject to penalties, including, without limitation, civil, criminal, and administrative penalties, damages, fines, disgorgement, the curtailment or

restructuring of our operations, exclusion from participation in federal and state healthcare programs, additional integrity oversight and reporting obligations, individual imprisonment, contractual damages, and reputational harm, any of which could adversely affect our ability to operate our business and our results of operations.

**Employees**

As of June 30, 2018, we had 65 employees, of which 28 work in sales, sales support and marketing, 28 work in research and development, four work in manufacturing and operations and five work in general and administrative. As of June 30, 2018, of our 65 employees, 57 were located in the U.S. and eight were employed outside the U.S. None of our employees is represented by a labor union or is subject to a collective bargaining agreement.

**Facilities**

We lease approximately 33,128 square feet of office, laboratory, and manufacturing space at our headquarters in San Diego, California, under a lease that expires on December 31, 2020. We believe that we will need additional space as we grow our operations, but believe that suitable additional or substitute space will be available to accommodate future growth of our business. We believe that our existing office, laboratory and manufacturing space will be sufficient to meet our needs in the interim.

## MANAGEMENT

### Executive Officers and Directors

The following table sets forth information regarding our directors and executive officers as of July 31, 2018.

<u>Name</u>	<u>Age</u>	<u>Position</u>
<i>Executive Officers:</i>		
R. Erik Holmlin, Ph.D.	50	President, Chief Executive Officer and Director
Mike Ward	47	Chief Financial Officer
Han Cao, Ph.D.	50	Chief Scientific Officer
Warren Robinson	49	Chief Commercial Officer
Mark Borodkin	44	Chief Operating Officer
<i>Non-Employee Directors:</i>		
David L. Barker, Ph.D.(1)(2)	77	Chairman, Director
Darren Cai, Ph.D.(1)	53	Director
Albert Luderer, Ph.D.(2)(3)	70	Director
Junfeng Wang(1)(3)	44	Director
Christopher Twomey(2)	58	Director
Quan Zhou(3)	43	Director

(1) Member of the compensation committee.

(2) Member of the audit committee.

(3) Member of the nominating and corporate governance committee.

### Executive Officers

**R. Erik Holmlin, Ph.D.** Dr. Holmlin has served as our President and Chief Executive Officer and as a member of our board of directors since January 2011. From June 2010 to February 2011, Dr. Holmlin served as president and Chief Executive Officer of GenVault Corporation, a private biosample management solutions company. Previously, Dr. Holmlin held positions as an entrepreneur in residence at Domain Associates, a dedicated life sciences venture capital firm; Chief Commercial Officer of Exiqon A/S, a publicly traded RNA research solutions company; founder and executive at GeneOhm Sciences, which was acquired by Becton Dickinson and Company; and a National Institutes of Health postdoctoral fellow at Harvard University. Until June 2016, Dr. Holmlin served as a director of Nanosphere, Inc., a publicly traded molecular diagnostic company, which was subsequently acquired by Luminex Corporation, a publicly traded biological testing company. Dr. Holmlin received his bachelor's degree in chemistry from Occidental College, his Ph.D. in chemistry from the California Institute of Technology and MBAs from University of California, Berkeley and Columbia University. Our board of directors believes that Dr. Holmlin's over 17 years of experience in the life sciences and health care industries, which includes the areas of technology development, product commercialization and venture financing, qualifies him to serve on our board of directors.

**Mike Ward.** Mr. Ward has served as our Chief Financial Officer since May 2018, and previously served as our Chief Business Officer from July 2017 and as our Vice President, Corporate Development since April 2014. From September 2009 to September 2013, Mr. Ward served as a Director and Vice President of the Private Equity and Venture Capital Investment team of Lurie Investment Fund. In addition, Mr. Ward previously served in investment banking positions at Leerink Partners, BMO Capital Markets, Dresdner Kleinwort Wasserstein, Prudential Securities and Credit Suisse. Mr. Ward has previously served on the boards of directors of public and private companies, including Nanosphere, Inc., CytoPherx, Inc., Aperion Biologics, Inc. and Impact Health, Inc. Mr. Ward has over 20 years of experience in the areas of investment banking, private equity and venture capital in the life sciences industry. Mr. Ward received his bachelor's degree in finance from the University of Illinois.

**Han Cao, Ph.D.** Dr. Cao founded Bionano in 2003 and has served as our Chief Scientific Officer since July 18, 2011. From January 2000 to October 2003, Dr. Cao worked as a Research Fellow in the Nanostructure

lab in the Department of Engineering at Princeton University. Dr. Cao was a postdoctoral fellow from October 2000 to December 2003 at the Institute for Human Gene Therapy, in the Department of Molecular and Cellular Biology at the University of Pennsylvania Medical Center. Dr. Cao received his bachelor's degree in molecular and cellular biology from the University of Science and Technology of China and his Ph.D. in molecular biology from the University of Delaware.

**Warren Robinson.** Mr. Robinson has served as our Chief Commercial Officer since November 2017 and previously served as a Vice President with us in various sales and marketing functions from October 2015 to November 2017, including most recently as our Vice President of Global Sales and Marketing. From June 2013 to October 2015, Mr. Robinson served as Division Vice President of Aegis Chemical Solutions, LLC, a private oil production services company. Previously, Mr. Robinson held various leadership roles in sales-focused positions with Life Technologies Corporation, a publicly traded research tools development company acquired by Thermo Fisher Scientific Inc. in February 2014, and Invitrogen Corporation, a publicly traded research tools development company acquired by Life Technologies in January 2008. Mr. Robinson received his bachelor's degree in biochemistry from The University of Lethbridge, a research university located in Canada.

**Mark Borodkin.** Mr. Borodkin has served as our Chief Operating Officer since November 2017 and previously served as our Vice President, Product Development and Operations since October 2014. From December 2011 to August 2014, Mr. Borodkin served as the Senior Director of Engineering and Chief Product Officer at Brooks Life Science Systems, a provider of automation and cryogenic solutions for the life science industry, and from April 2009 to October 2011 as a Director of Engineering at Affymetrix, Inc., a private life science systems company that was acquired by Thermo Fisher Scientific in March 2016. From December 2007 to April 2009, Mr. Borodkin served as a Senior Manager and Core Team Leader of R&D for Siemens Healthcare Diagnostics, and for the prior 13 years, he developed sequencing and real-time PCR systems at Applied Biosystems, now a part of Thermo Fisher Scientific. Mr. Borodkin received both his bachelor's degree in electrical engineering and his master's degree in computer and systems engineering from Rensselaer Polytechnic Institute.

#### **Non-Employee Directors**

**David L. Barker, Ph.D.** Dr. Barker has served on our board of directors since May 2010, and as Chairman of our board of directors since August 2016. Dr. Barker also serves as a member of the board of directors of AmideBio, LLC, a private biotechnology company, Singular Genomics Systems, Inc., a private biotechnology company, and Integrated Diagnostics Inc., a private molecular diagnostics company. In addition, Dr. Barker is a scientific advisor to MiNDERA Corp., a private molecular dermatology company, and Luna DNA Inc., a private medical research database company. From January 2000 to January 2007, Dr. Barker served as Vice President and Chief Scientific Officer of Illumina, Inc., a public DNA sequencing technology company, and until May 2016 served as a member of the scientific advisory board of Illumina. Dr. Barker previously served as a member of the board of directors of IntegenX, Inc., a private Rapid human DNA identification technology company acquired by Thermo Fisher Scientific in May 2018, Zephyrus Biosciences, Inc., a private protein analysis research platform company acquired by Bio-Techne Corporation, a public life sciences company, in March 2016, ProteinSimple, a private protein analysis platform development company acquired by BioTechne in June 2014, and NextBio, a private genomic data analysis company acquired by Illumina in October 2013. Dr. Barker received his bachelor's degree in chemistry from the California Institute of Technology and a Ph.D. in biochemistry from Brandeis University. Our board of directors believes Dr. Barker's extensive experience in managing and leading early stage and established companies within the clinical diagnostic and biotechnology industries qualifies him to serve on our board of directors.

**Darren Cai, Ph.D.** Dr. Cai has served on our board of directors since September 2014. From April 2015 to April 2018, Dr. Cai served as a Managing Director of Legend Capital, a Chinese early stage and expansion stage venture capital firm, and held a previous position as a Director of Legend Capital from October 2012. Dr. Cai also served as Chief Financial Officer of Beijing Genomics Institute, a genome sequencing company, from 2014



to 2016. During his tenure at Legend Capital, Dr. Cai focused on investment opportunities in the healthcare sector and led investment in more than 20 companies located in the U.S. and China. In addition, Dr. Cai previously served on the board of directors of Beijing Genomics Institute. Dr. Cai received his bachelor's degree in biophysics from the University of Science and Technology of China, MBA from Yale University and Ph.D. in vision science from the University of California, Berkeley. Our board of directors believes Dr. Cai's extensive experience in managing and developing investment and business opportunities within the health care sector qualifies him to serve on our board of directors.

**Albert Luderer, Ph.D.** Dr. Luderer has served on our board of directors since October 2011. Since March 2010, Dr. Luderer has served as Chief Executive Officer and a member of the board of directors of Integrated Diagnostics Inc., a private molecular diagnostics company. In addition, Dr. Luderer currently serves as the Chief Executive Officer and a member of the board of directors of Indi Molecular, Inc., synthetic antibody technology company, and as a the Executive Chairman of the board of directors of Prostate Management Diagnostics Inc. Dr. Luderer has over 30 years of experience in executive leadership roles in the areas of technology development, operations and business development. Dr. Luderer received his bachelor's degree in zoology from Drew University and his MS in immunochemistry and Ph.D. in immunogenics from Rutgers University. Our board of directors believes Dr. Luderer's experience in the biotechnology sector, with special focuses on technology, business development and commercialization, qualifies him to serve on our board of directors.

**Junfeng Wang.** Mr. Wang has served on our board of directors since February 2018. Since October 2009, Mr. Wang has served as a Managing Director of Legend Capital, and held previous positions with Legend Capital as Executive Director from October 2007, Senior Vice President from October 2006 and Vice President from October 2005. Through his tenure at Legend Capital, Mr. Wang has worked in the healthcare and chemical industries, developing research and investment expertise in growth capital investment. Mr. Wang received his bachelor's degree in polymer chemistry from Lanzhou University, a research university located in China, and his MBA from McMaster University, a research university located in Canada. Our board of directors believes Mr. Wang's extensive experience as a venture capital investor in the healthcare and chemical industries qualifies him to serve on our board of directors.

**Christopher J. Twomey** has served on our board of directors since July 2018. Since March 2006, Mr. Twomey has served as a director of Senomyx, Inc., a taste technologies company. Since August 2013, Mr. Twomey has served as a director and Chairman of the Audit Committee of Tandem Diabetes Care, Inc., a medical device company. From March 1990 to June 2007, Mr. Twomey served in various roles, including as Senior Vice President, Finance and Chief Financial Officer, at Biosite Incorporated, a medical diagnostics company. From October 1981 to March 1990, Mr. Twomey served as an audit manager for Ernst & Young, LLP. From July 2006 to March 2014, Mr. Twomey also served as a director and Chairman of the Audit Committee of Cadence Pharmaceuticals, Inc., a specialty pharmaceutical company that was acquired by Mallinckrodt plc in 2014. Mr. Twomey received his bachelors degree in Business Economics from the University of California at Santa Barbara. Mr. Twomey contributes substantial leadership skills and expertise in accounting and financial reporting that are especially valuable in his role as Chairman of our Audit Committee.

**Quan Zhou.** Mr. Zhou has served on our board of directors since February 2018. Since April 2016, Mr. Zhou has served as an Executive Director at Legend Capital, and held previous positions as Director from April 2015 and Vice President from October 2012. During his tenure at Legend Capital, Mr. Zhou has focused on the Medtech and diagnostics industries. Mr. Zhou received his bachelor's degree in Biology from the University of Science and Technology in China, his Masters in Neuroscience from the National University of Singapore, and his MBA from the China Europe International Business School. Our board of directors believes Mr. Zhou's extensive experience in investment in the healthcare sector qualifies him to serve on our board of directors.

There are no family relationships among any of our directors or executive officers.

### **Composition of Our Board of Directors**

Our business and affairs are managed under the direction of our board of directors. Each of our current directors was elected to serve as a member of our board of directors pursuant to a stockholders agreement dated August 5, 2016, as amended, by and among us and certain of our stockholders. Pursuant to the stockholders agreement: (1) Dr. Holmlin was designated to serve on our board of directors as the then serving chief executive officer; (2) Mr. Zhou was designated by LC Fund VI, L.P., LC Parallel Fund VI, L.P. and LC HealthCare Fund I, and their affiliates, collectively referred to as LC, to serve on our board of directors as a representative of the holders of our Series C convertible preferred stock; (3) Mr. Wang was designated by LC to serve on our board of directors as a representative of the holders of our Series D-1 convertible preferred stock stockholders; and (4) Dr. Luderer, Dr. Barker, Dr. Cai and Mr. Twomey were designated to serve on our board of directors as independent directors. The stockholders agreement will terminate upon the closing of this offering, and thereafter no stockholder will have any special rights regarding the election or designation of the members of our board of directors.

We currently have seven directors, and 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 to be filed in connection with 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 Dr. Holmlin and Dr. Barker, and their terms will expire at the annual general meeting of stockholders to be held in 2019;
- the Class II directors will be Dr. Luderer and Mr. Zhou, and their terms will expire at the annual general meeting of stockholders to be held in 2020; and
- the Class III director will be Dr. Cai, Mr. Twomey and Mr. Wang, and their terms will expire at the annual general meeting of stockholders to be held in 2021.

### **Board Leadership Structure**

Our board of directors is currently chaired by Dr. Barker, who has authority, among other things, to call and preside over board of directors meetings, to set meeting agendas and to determine materials to be distributed to the board of directors. Accordingly, the chairperson of our board of directors has substantial ability to shape the work of the board of directors. We believe that separation of the positions of chairperson and chief executive officer reinforces the independence of our board of directors in its oversight of our business and affairs. In addition, we have a separate chair for each committee of our board of directors. The chair of each committee is expected to report annually to our board of directors on the activities of their committee in fulfilling their responsibilities as detailed in their respective charters or specify any shortcomings should that be the case.

### **Role of the Board in Risk Oversight**

The audit committee of our board of directors is primarily responsible for overseeing our risk management processes on behalf of our board of directors. Going forward, we expect that the audit committee will receive reports from management at least quarterly regarding our assessment of risks. In addition, the audit committee reports regularly to our board of directors, which also considers our risk profile. The audit committee and our board of directors focus on the most significant risks we face and our general risk management strategies. While our board of directors oversees our risk management, management is responsible for day-to-day risk management processes. Our board of directors expects management to consider risk and risk management in each business decision, to proactively develop and monitor risk management strategies and processes for

day-to-day activities and to effectively implement risk management strategies adopted by the audit committee and our board of directors. We believe this division of responsibilities is the most effective approach for addressing the risks we face and that our board of directors' leadership structure, which also emphasizes the independence of our board of directors in its oversight of its business and affairs, supports this approach.

### **Director Independence**

Under the listing requirements and rules of Nasdaq, independent directors must comprise a majority of our board of directors as a listed company within one year of the listing date. Our board of directors has undertaken a review of the independence of each director. Based on information provided by each director concerning her or his background, employment and affiliations, our board of directors has determined that all of our directors, except Dr. Holmlin, are independent directors, as defined by Rule 5605(a)(2) of the Nasdaq Listing Rules.

### **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 Mr. Twomey, Dr. Luderer and Dr. Barker, each of whom our board of directors has determined 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. Twomey, who our board of directors has determined 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, the board of directors has examined each audit committee member's scope of experience and the nature of their employment in the corporate finance sector.

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 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.

### ***Compensation Committee***

Our compensation committee consists of Dr. Barker, Dr. Cai and Mr. Wang. The chair of our compensation committee is Dr. Barker. Our board of directors has determined that each member of the compensation committee is independent under the Nasdaq listing standards, a “non-employee director” as defined in Rule 16b-3 promulgated under the Exchange Act and an “outside director” as that term is defined in Section 162(m) of the Code.

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 approving the compensation of our chief executive officer, other executive officers and senior management;
- reviewing and recommending to our board of directors the compensation paid to our directors;
- reviewing and approving the compensation arrangements with our executive officers and other senior management;
- 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;
- reviewing, evaluating and recommending to our board of directors succession plans for our executive officers; and
- reviewing and establishing general policies relating to compensation and benefits of our employees, including our overall compensation philosophy.

### ***Nominating and Corporate Governance Committee***

Our nominating and corporate governance committee consists of Dr. Luderer, Mr. Wang and Mr. Zhou. The chair of our nominating and corporate governance committee is Dr. Luderer. Our board of directors has determined that each member of the nominating and corporate governance committee is independent under the Nasdaq listing standards, a non-employee director, and free from any relationship that would interfere with the exercise of his or her independent judgment.

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;
- instituting plans or programs for the continuing education of our board of directors and orientation of new 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 and management.

### **Code of Business Conduct and Ethics**

Effective upon the completion of this offering, we will adopt a code of business conduct and ethics that applies to all our employees, officers and directors. This includes our principal executive officer, principal financial officer and principal accounting officer or controller, or persons performing similar functions. The full text of our code of business conduct and ethics will be posted on our website at [www.bionanogenomics.com](http://www.bionanogenomics.com). We intend to disclose on our website any future amendments to our code of business conduct and ethics or waivers that exempt any principal executive officer, principal financial officer, principal accounting officer or controller, persons performing similar functions or our directors from provisions in our code of business conduct and ethics. Information contained in, 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.

### **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 calendar 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.

### **Director Compensation**

Our board of directors adopted a non-employee director compensation policy in July 2018 that will become effective upon the execution and delivery of the underwriting agreement related to this offering and will be applicable to each member of our board of directors who is not also serving as an employee or consultant to the Company. This compensation policy provides that each such non-employee director will receive the following compensation for service on our board of directors:

- an annual cash retainer of \$30,000;
- an additional annual cash retainer of \$20,000 for service as chairman of the board of directors;
- an additional annual cash retainer of \$15,000, \$10,000 and \$10,000 for service as chair of the audit committee, compensation committee and the nominating and corporate governance committee, respectively;
- an additional annual cash retainer of \$7,500, \$5,000 and \$5,000 for service as a member of the audit committee, compensation committee and the nominating and corporate governance committee, respectively (not applicable to committee chairs);
- an initial option grant to purchase common stock with an aggregate Black-Scholes option value of \$50,000 on the date of each such non-employee director's appointment to our board of directors; and
- an annual option grant to purchase common stock with an aggregate Black-Scholes option value of \$35,000 on the date of each of our annual stockholder meetings.

Each of the option grants described above will be granted under our 2018 Plan, the terms of which are described in more detail below under "— Equity Benefit Plans — 2018 Equity Incentive Plan." Each such option grant will vest and become exercisable subject to the director's continuous service to us, provided that each option will vest in full upon a change in control (as defined in the 2018 Plan). The term of each option will be 10 years, subject to earlier termination as provided in the 2018 Plan, provided that upon a termination of service other than for death, disability or cause, the post-termination exercise period will be 12 months from the date of termination. An eligible director may decline all or any portion of his or her compensation by giving notice to the Company prior to the date cash may be paid or equity awards are to be granted, as the case may be.

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. Dr. Holmlin, our

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President and Chief Executive Officer, is also a director but did not receive any additional compensation for his service as a director. See the section titled "Executive Compensation" for more information regarding the compensation earned by Dr. Holmlin.

The following table sets forth in summary form information concerning the compensation that was earned by each of our non-employee directors during the year ended December 31, 2017:

NAME	FEES EARNED OR PAID IN		OPTION AWARDS \$(1)	TOTAL (\$)
	CASH			
David L. Barker, Ph.D.	\$	30,000	\$ 8,066	\$ 38,066
Darren Cai, Ph.D.	\$	—	\$ —	\$ —
Brian K. Halak, Ph.D.(2)	\$	—	\$ 5,500	\$ 5,500
Albert Luderer, Ph.D.	\$	10,000	\$ 5,500	\$ 15,500
Junfeng Wang	\$	—	\$ —	\$ —
Christopher Twomey(3)	\$	—	\$ —	\$ —
Quan Zhou(4)	\$	—	\$ —	\$ —

- (1) The amounts reported reflect the aggregate grant date fair value of each equity award granted to our non-employee directors during the fiscal year ended December 31, 2017, as computed in accordance with Financial Accounting Standard Board Accounting Standards Codification Topic 718 for stock-based compensation transactions (ASC 718). Assumptions used in the calculation of these amounts are included in Note 2 to our financial statements for the fiscal year ended December 31, 2017. As required by SEC rules, the amounts shown exclude the impact of estimated forfeitures related to service-based vesting conditions. These amounts do not reflect the actual economic value that will be realized by our non-employee directors upon the vesting of the stock options, the exercise of the stock options, or the sale of the common stock underlying such stock options. As of December 31, 2017, the aggregate number of shares outstanding under all options to purchase our common stock held by our non-employee directors were: Dr. Barker, 13,392; Dr. Halak, 9,042; and Dr. Luderer, 9,182. None of our non-employee directors held unvested stock awards as of December 31, 2017.
- (2) Dr. Halak resigned from our Board of Directors in May 2018.
- (3) Mr. Twomey was appointed to our Board of Directors in July 2018.
- (4) Mr. Zhou was appointed to our Board of Directors in July 2018.

**EXECUTIVE COMPENSATION**

Our named executive officers for the year ended December 31, 2017, consisting of our principal executive officer and the next two most highly compensated executive officers, were:

- R. Erik Holmlin, Ph.D., our Chief Executive Officer;
- Mike Ward, our Chief Financial Officer; and
- Han Cao, Ph.D., our Chief Scientific Officer.

**Summary Compensation Table**

The following table presents all of the compensation awarded to or earned by or paid to our named executive officers during the fiscal year ended December 31, 2017.

<u>Name and Principal Position</u>	<u>Year</u>	<u>Salary (\$)</u>	<u>Bonus (\$)</u>	<u>Option Awards(1) (\$)</u>	<u>Non-Equity Incentive Plan Compensation(2) (\$)</u>	<u>All Other Compensation(3) (\$)</u>	<u>Total (\$)</u>
R. Erik Holmlin, Ph.D. <i>Chief Executive Officer</i>	2017	378,628	—	93,786	118,132	14,784	605,330
Mike Ward <i>Chief Financial Officer</i>	2017	289,380	—	20,841	72,056	14,198	396,475
Han Cao, Ph.D. <i>Chief Scientific Officer</i>	2017	300,451	—	31,262	45,518	14,468	391,699

- (1) In accordance with SEC rules, this column reflects the aggregate grant date fair value of stock options granted to our named executive officers during fiscal year ended December 31, 2017 under our 2006 Plan, computed in accordance with ASC 718. The valuation assumptions used in calculating the fair value of the stock options are included in Note 2 to our financial statements included elsewhere in this prospectus. These amounts do not reflect the actual economic value that may be realized by the named executive officer upon the vesting of the stock options, the exercise of the stock options, or the sale of the common stock underlying such stock options.
- (2) Amounts reported represent bonuses earned for 2017 and paid in 2018 at the discretion of our board of directors.
- (3) Amounts reflect the following: for Mr. Holmlin, \$14,424 for 401(k) matching contributions and \$360 for life insurance premiums; for Mr. Ward, \$13,838 for 401(k) matching contributions and \$360 for life insurance premiums; for Mr. Cao, \$14,108 for 401(k) matching contributions and \$360 for life insurance premiums.

**Annual Base Salary**

The compensation of our named executive officers is generally determined and approved by our board of directors, based on the recommendation of the compensation committee of our board of directors. The 2017 base salaries that became effective as of February 7, 2017 were as follows:

<u>NAME</u>	<u>2017 BASE SALARY (\$)</u>
R. Erik Holmlin, Ph.D.	378,628
Mike Ward	289,380
Han Cao, Ph.D.	300,451

**Bonus Opportunity**

In addition to base salaries, our named executive officers are eligible to receive annual performance-based cash bonuses, which are designed to provide appropriate incentives to our executives to achieve defined annual

performance goals and to reward our executives for individual achievement towards these goals. The annual performance-based bonus each named executive officer is eligible to receive is generally based on the extent to which we achieve the corporate goals that our compensation committee establishes each year and, for all except Dr. Holmlin, the individual's contributions to such achievements. Dr. Holmlin's payout is based entirely on Company performance, Dr. Cao's payout is based on Company performance (25% weighting) and his individual performance (75% weighting), and Mr. Ward's payout is based on Company performance (50% weighting) and his individual performance (50% weighting). At the end of the year, our board of directors reviews each executive's performance and determines the actual bonus payout to be awarded to each of our named executive officers.

For 2017, the target bonus for Dr. Holmlin was 40% of base salary, for Dr. Cao was 20% of base salary and for Mr. Ward was 30% of base salary. Our corporate performance objectives for 2017, as established by our compensation committee, included achievement of our 2017 operating plan, launch of our Saphyr instrument, accomplishment of product development milestones, entry into product development and marketing arrangements and securing additional financing. In March 2018, our board of directors approved a 78% overall achievement level of our corporate goals and awarded bonuses to our named executive officers based on Company achievements and, except for Dr. Holmlin, on individual performance in 2017.

### **Equity-Based Incentive Awards**

We believe that our ability to grant equity-based awards is a valuable and necessary compensation tool that aligns the long-term financial interests of our employees, consultants and directors with the financial interests of our stockholders. In addition, we believe that our ability to grant equity-based awards helps us to attract, retain and motivate employees, consultants and directors, and encourages them to devote their best efforts to our business and financial success. Our board of directors is responsible for approving equity grants. Vesting of equity awards is generally tied to continuous service with us and serves as an additional retention measure. Our executives generally are awarded an initial new hire grant upon commencement of employment. Additional grants may occur periodically in order to specifically incentivize executives with respect to achieving certain corporate goals or to reward executives for exceptional performance.

Prior to this offering, we have granted all equity awards pursuant to the 2006 Plan, the terms of which are described below under "—Equity Benefit Plans." All options are granted with a per share exercise price equal to no less than the fair market value of a share of our common stock on the date of the grant of such award. Generally our stock option awards vest over a three-year period subject to the holder's continuous service to us.

In February 2017, our board of directors granted options to purchase 153,988 shares to Dr. Holmlin, 51,328 shares to Dr. Cao and 34,219 shares to Mr. Ward. Each option has an exercise price of \$1.28 per share and vests as follows: 25% of the shares subject to the option are fully vested and 6.25% of the shares subject to the option vest at the end of each three month anniversary of vesting commencement date, subject to single trigger acceleration of vesting in connection with a change of control, provided in each case that the holder is then providing services to us in accordance with the terms of the 2006 Plan. For additional information, please see below under "—Outstanding Equity Awards at Fiscal Year-End."

In August 2018, our board of directors amended all outstanding options held as of such date by Dr. Holmlin and Mr. Ward such that, contingent upon and following the date of the underwriting agreement related to this offering, the vesting of all such awards will be suspended until such time as the closing price of our common stock is at least \$12.00 per share for 90 consecutive trading days, at which point the suspension will automatically and immediately lapse and the awards will vest to the extent they otherwise would have vested pursuant to their terms and notwithstanding the suspension and will continue to vest thereafter under their original vesting schedules. In addition, the suspension will lapse as to the awards held by Dr. Holmlin or Mr. Ward upon Dr. Holmlin's or Mr. Ward's respective death, disability or upon a change in control of the Company, as such terms are defined in the 2018 Plan.



### **Agreements with Our Named Executive Officers**

Below are descriptions of our employment agreements with our named executive officers. For a discussion of the severance pay and other benefits to be provided in connection with a termination of employment and/or a change in control under the arrangements with our named executive officers, please see “—Potential Payments upon Termination or Change in Control” below.

*Dr. Holmlin.* We entered into an employment agreement with Dr. Holmlin in January 2011, as amended in March 2011 and in November 2017, which governs the current terms of his employment with us. Pursuant to the agreement, as amended, Dr. Holmlin was entitled to an initial annual base salary of \$315,000 and is eligible to receive an annual performance bonus with a target of 40% of his base salary, with a higher amount possible if goals exceeding target are achieved, as determined by our compensation committee and subject to approval by our board of directors. In addition, Dr. Holmlin was eligible to receive an option to purchase shares of the Company’s common stock representing 5.0% of the fully-diluted equity shares immediately subsequent to the closing of a Series B transaction, which were equal to 2,992 shares of our common stock and were granted in 2011. In addition, Dr. Holmlin’s agreement provided for additional options to be granted in connection with specified events in order to maintain Dr. Holmlin’s ownership percentage, pursuant to which Dr. Holmlin was granted additional options to purchase 1,115 shares in 2012 and 2,546 shares in 2015. No obligations to make additional grants to maintain Dr. Holmlin’s ownership percentage remain under his employment agreement. Dr. Holmlin’s employment is at will.

*Mr. Ward.* We entered into an employment agreement with Mr. Ward in July 2016, which governs the current terms of his employment with us. Pursuant to the agreement, Mr. Ward was entitled to an initial annual base salary of \$278,250 and is eligible to receive an annual performance bonus with a target amount of up to 30% of his base salary, as determined by our board of directors. Mr. Ward’s employment is at will.

*Dr. Cao.* We entered into an employment agreement with Dr. Cao in July 2011, as amended in November 2017, which governs the current terms of his employment with us. Pursuant to the agreement, Dr. Cao was entitled to an initial annual base salary of \$250,000 and a one-time signing bonus of \$40,000 in cash. Dr. Cao received certain benefits in connection with his relocation, which were paid in 2012. Dr. Cao is eligible to receive an annual performance bonus with a target amount of 20% of his base salary based on the Company’s performance (25% weighting) and Dr. Cao’s individual performance (75% weighting), as determined by our board of directors. In addition, Dr. Cao was eligible to receive an option to purchase a number of shares of the Company’s common stock that, together with shares and/or options then owned by Dr. Cao and the shares of Series B preferred stock of the Company that was to be issued to Dr. Cao as described in his employment agreement, represented no less than 7.5% of the total outstanding shares of the common stock of the Company on a fully diluted basis, which was equal to 2,344 shares of our common stock and was granted in 2011. No obligations to make additional grants to maintain Dr. Cao’s ownership percentage remain under his employment agreement. Dr. Cao was also entitled to a bonus consisting of 240,800 shares of Series B preferred stock of the Company pursuant to the terms of a restricted stock purchase agreement entered into in August 2011. Dr. Cao’s employment is at will.

### **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 term of service, including unpaid salary and unused vacation. In addition, each of our named executive officers is eligible to receive certain benefits pursuant to his employment agreement with us, as described below. For the definitions of “cause,” “good reason” and “disability” referenced below, please refer to the individual employment agreements with each of our named executive officers.

*Dr. Holmlin.* Upon Dr. Holmlin’s termination for any reason other than death, disability, cause or resignation without good reason, and subject to Dr. Holmlin’s execution of a release, Dr. Holmlin shall be

eligible to receive (i) a lump sum amount equal to nine months of base salary, (ii) accelerated vesting of any options or restricted shares that would have vested within 18 months after the date of termination and (iii) premiums for continued health coverage for nine months following the date of termination, or until Dr. Holmlin is no longer eligible for continuation coverage, whichever is earlier. In the event of termination due to disability, and subject to Dr. Holmlin's execution of a release, Dr. Holmlin shall be eligible to receive accelerated vesting in full for any unvested portion of the options granted pursuant to his agreement. In the event of a deemed liquidation event (as defined in Dr. Holmlin's employment agreement), the options granted to Dr. Holmlin pursuant to his agreement shall vest in full.

*Mr. Ward.* Upon termination without cause, and subject to Mr. Ward's execution of a release, Mr. Ward will be eligible to receive (i) six months of continued base salary payments at the rate in effect at the time of termination and (ii) premiums for continued health coverage for six months following the date of termination or until Mr. Ward is no longer eligible for continuation coverage or he becomes eligible for new healthcare eligibility available through new employment, whichever is earlier.

*Dr. Cao.* Upon Dr. Cao's termination without cause or resignation for good reason, and subject to Dr. Cao's execution of a release, Dr. Cao will be eligible to receive (i) six months of continued base salary, to be paid on the Company's normal pay days commencing with the first regular payroll date of the Company following the effective date of the release, and (ii) premiums for continued health coverage for a period of six months following the date of termination or until Dr. Cao is no longer eligible for such coverage, whichever is earlier. In addition, Dr. Cao's unvested options shall immediately vest as if Dr. Cao had been employed for an additional six months from the date of termination, since more than two years has passed from start of Dr. Cao's employment. Upon Dr. Cao's termination by death or disability, Dr. Cao's unvested options shall immediately vest as if Dr. Cao had been employed for an additional six months from the date of termination, since more than two years has passed from the start of Dr. Cao's employment.

Each of our named executive officers holds stock options under the 2006 Plan that were granted subject to the general terms of the 2006 Plan and the form of stock option agreement. A description of the termination and change of control provisions in the 2006 Plan and stock options granted thereunder is provided below under "—Equity Benefit Plans" and the specific vesting terms of each named executive officer's stock options are described below under "—Outstanding Equity Awards at Fiscal Year-End."

**Outstanding Equity Awards at Fiscal Year-End**

The following table presents information regarding outstanding equity awards held by our named executive officers as of December 31, 2017.

Name	Grant Date	Option Awards <sup>(1)</sup>			
		Number of Securities Underlying Unexercised Options Exercisable	Number of Securities Underlying Unexercised Options Unexercisable	Option Exercise Price Per Share <sup>(2)</sup>	Option Expiration Date
R. Erik Holmlin, Ph.D. <sup>(5)</sup>	2/7/2017 <sup>(3)</sup>	67,369	86,619	\$ 1.28	2/6/2027
	1/29/2015 <sup>(4)</sup>	3,257	1,480	\$ 64.20	1/28/2025
	1/29/2015	2,546	—	\$ 64.20	1/28/2025
	6/20/2012	1,115	—	\$ 68.48	6/19/2022
	5/16/2011	2,992	—	\$ 42.80	5/15/2021
Mike Ward <sup>(5)</sup>	2/7/2017 <sup>(3)</sup>	14,971	19,248	\$ 1.28	2/6/2027
	1/29/2015 <sup>(4)</sup>	697	317	\$ 64.20	1/28/2025
	4/21/2014 <sup>(4)</sup>	535	76	\$ 81.32	4/20/2024
Han Cao, Ph.D.	2/7/2017 <sup>(3)</sup>	22,456	28,872	\$ 1.28	2/6/2027
	1/29/2015 <sup>(4)</sup>	1,758	799	\$ 64.20	1/28/2025
	1/29/2015	1,599	—	\$ 64.20	1/28/2025
	8/10/2011	2,344	—	\$ 42.80	8/9/2021
	4/2/2010	46	—	\$ 38.52	4/1/2020
	1/15/2009	46	—	\$291.04	1/14/2019

- (1) All of the option awards were granted under the 2006 Plan, the terms of which plan is described below under “—Equity Benefit 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.
- (3) Each option award vests as follows: 25% of the shares subject to the option are fully vested and 6.25% of the shares subject to the option vest at the end of each three month anniversary of the vesting commencement date, subject to single trigger acceleration of vesting in connection with a change of control, provided in each case that the holder is then providing services to us in accordance with the terms of the 2006 Plan.
- (4) Each option award vests as follows: 25% of the shares subject to the option shall vest at the end of the first anniversary of the vesting commencement date, and 6.25% of the shares subject to the option vest at the end of each three month anniversary of the vesting commencement date, subject to single trigger acceleration of vesting in connection with a change of control, provided in each case that the holder is then providing services to us in accordance with the terms of the 2006 Plan.
- (5) All outstanding options held by Dr. Holmlin and Mr. Ward were amended by our board of directors in August 2018 to suspend the vesting until the achievement of certain milestones, as further described above under “—Equity-Based Incentive Awards.”

**Perquisites, Health, Welfare and Retirement 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, accidental death and dismemberment insurance for all of our employees, including our named executive officers. In addition, we provide a 401(k) plan to our employees, including our named executive officers, as discussed in the section below entitled “—401(k) Plan.” We generally do not provide perquisites or personal benefits to our named executive officers.

### **Nonqualified Deferred Compensation**

Our named executive officers did not participate in, or earn any benefits under, a nonqualified deferred compensation plan sponsored by us during the fiscal year ended December 31, 2017. Our board of directors may elect to provide our officers and other employees with nonqualified defined contribution or other nonqualified deferred compensation benefits in the future if it determines that doing so is in our best interests.

### **401(k) Plan**

We maintain a defined contribution employee retirement plan, or 401(k) plan, for our employees. Our named executive officers are eligible to participate in the 401(k) plan on the same basis as our other employees. The 401(k) plan is intended to qualify as a tax-qualified plan under Section 401(k) of the Code. The plan permits us to make discretionary contributions, including matching contributions and discretionary profit sharing contributions. The 401(k) plan currently does not offer the ability to invest in our securities.

### **Equity Benefit Plans**

The principal features of our equity plans are summarized below. These summaries are qualified in their entirety by reference to the actual text of the plans, which are filed as exhibits to the registration statement of which this prospectus is a part.

#### ***2018 Equity Incentive Plan***

Our board of directors adopted our 2018 Plan in July 2018 and our stockholders approved our 2018 Plan in July 2018. Our 2018 Plan provides for the grant of incentive stock options, or ISOs, within the meaning of Section 422 of the Code, to employees, including employees of any parent or subsidiary, and for the grant of nonstatutory stock options, or NSOs, stock appreciation rights, restricted stock awards, restricted stock unit awards, performance stock awards, performance cash awards and other forms of stock awards to employees, directors and consultants, including employees and consultants of our affiliates. Our 2018 Plan is a successor to and continuation of our 2006 Plan. No stock awards may be granted under the 2018 Plan until the date of the underwriting agreement related to this offering.

*Authorized Shares.* Initially, the maximum number of shares of our common stock that may be issued under our 2018 Plan after it becomes effective will be 1,499,454 shares, which is the sum of (1) 1,000,000 new shares, plus (2) the number of shares (not to exceed 499,454 shares) (i) that remain available for the issuance of awards under our 2006 Plan at the time our 2018 Plan becomes effective, and (ii) any shares subject to outstanding stock options or other stock awards that were granted under our 2006 Plan that are forfeited, terminate, expire, are reacquired, withheld (or not issued) to satisfy a tax withholding obligation or the purchase or exercise price. In addition, the number of shares of our common stock reserved for issuance under our 2018 Plan will automatically increase on January 1 of each calendar year, starting on January 1, 2019 (assuming the 2018 Plan becomes effective in 2018) through January 1, 2028, in an amount equal to 5% of the total number of shares of our capital stock outstanding on the last day of the calendar month before the date of each automatic increase, or a lesser number of shares determined by our board of directors. The maximum number of shares of our common stock that may be issued on the exercise of ISOs under our 2018 Plan is 2,998,908.

Shares subject to stock awards granted under our 2018 Plan that expire or terminate without being exercised in full, or that are paid out in cash rather than in shares, do not reduce the number of shares available for issuance under our 2018 Plan. Additionally, shares become available for future grant under our 2018 Plan if they were issued under stock awards under our 2018 Plan if we repurchase them or they are forfeited. This includes shares used to pay the exercise price of a stock award or to satisfy the tax withholding obligations related to a stock award.

The maximum number of shares of common stock subject to stock awards granted under the 2018 Plan or otherwise during a single 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 \$500,000 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 the board of directors, \$800,000.

*Plan Administration.* Our board of directors, or a duly authorized committee of our board of directors, will administer our 2018 Plan. Our board of directors may also delegate to one or more of our officers the authority to (1) designate employees (other than officers) to receive specified stock awards and (2) determine the number of shares subject to such stock awards. Under our 2018 Plan, our board of directors has the authority to determine and amend the terms of awards and underlying agreements, including:

- recipients;
- the exercise, purchase or strike price of stock awards, if any;
- the number of shares subject to each stock award;
- the vesting schedule applicable to the awards, together with any vesting acceleration; and
- the form of consideration, if any, payable on exercise or settlement of the award.

Under the 2018 Plan, the board of directors also generally has the authority to effect, with the consent of any adversely affected participant:

- the reduction of the exercise, purchase, or strike price of any outstanding award;
- the cancellation of any outstanding award and the grant in substitution therefore of other awards, cash, or other consideration; or
- any other action that is treated as a repricing under generally accepted accounting principles.

*Stock Options.* ISOs and NSOs are granted under stock option agreements adopted by the plan administrator. The plan administrator determines the exercise price for stock options, within the terms and conditions of the 2018 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 2018 Plan vest at the rate specified in the stock option agreement as determined by the plan administrator.

*Tax Limitations on Incentive Stock Options.* 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 award 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 generally be treated as NSOs. No ISO 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 affiliates 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 Unit Awards.* Restricted stock units are granted under restricted stock unit award agreements adopted by the plan administrator. Restricted stock units may be granted in consideration for any form of legal consideration that may be acceptable to our board of directors and permissible under applicable law. A restricted stock unit 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 agreement. Additionally, dividend equivalents may be credited in respect of shares covered by a restricted stock unit. Except as otherwise provided in the applicable award agreement, restricted stock units that have not vested will be forfeited once the participant's continuous service ends for any reason.

*Restricted Stock Awards.* Restricted stock awards are granted under restricted stock award agreements adopted by the plan administrator. A restricted stock award may be awarded in consideration for cash, check,

bank draft or money order, past or future services to us, or any other form of legal consideration that may be acceptable to our board of directors and permissible under applicable law. The plan administrator determines the terms and conditions of restricted stock awards, including vesting and forfeiture terms. If a participant's service relationship with us ends for any reason, we may receive any or all of the shares of common stock held by the participant that have not vested as of the date the participant terminates service with us through a forfeiture condition or a repurchase right.

*Stock Appreciation Rights.* Stock appreciation rights are granted under stock appreciation grant agreements adopted by the plan administrator. The plan administrator determines the purchase price or 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. A stock appreciation right granted under the 2018 Plan vests at the rate specified in the stock appreciation right agreement as determined by the plan administrator.

*Performance Awards.* The 2018 Plan permits the grant of performance-based stock and cash awards. Our compensation committee may structure awards so that the stock or cash will be issued or paid only following the achievement of certain pre-established performance goals during a designated performance period.

The performance goals that may be selected include one or more of the following: (i) sales; (ii) revenues; (iii) assets; (iv) expenses; (v) market penetration or expansion; (vi) earnings from operations; (vii) earnings before or after deduction for all or any portion of interest, taxes, depreciation, amortization, incentives, service fees or extraordinary or special items, whether or not on a continuing operations or an aggregate or per share basis; (viii) net income or net income per common share (basic or diluted); (ix) return on equity, investment, capital or assets; (x) one or more operating ratios; (xi) borrowing levels, leverage ratios or credit rating; (xii) market share; (xiii) capital expenditures; (xiv) cash flow, free cash flow, cash flow return on investment, or net cash provided by operations; (xv) stock price, dividends or total stockholder return; (xvi) development of new technologies or products; (xvii) sales of particular products or services; (xviii) economic value created or added; (xix) operating margin or profit margin; (xx) customer acquisition or retention; (xxi) raising or refinancing of capital; (xxii) successful hiring of key individuals; (xxiii) resolution of significant litigation; (xxiv) acquisitions and divestitures (in whole or in part); (xxv) joint ventures and strategic alliances; (xxvi) spin-offs, split-ups and the like; (xxvii) reorganizations; (xxviii) recapitalizations, restructurings, financings (issuance of debt or equity) or refinancings; (xxix) or strategic business criteria, consisting of one or more objectives based on the following goals: achievement of timely development, design management or enrollment, meeting specified market penetration or value added, payor acceptance, patient adherence, peer reviewed publications, issuance of new patents, establishment of or securing of licenses to intellectual property, product development or introduction (including, without limitation, discovery of novel products, maintenance of multiple products in pipeline, product launch or other product development milestones), geographic business expansion, cost targets, cost reductions or savings, customer satisfaction, operating efficiency, acquisition or retention, employee satisfaction, information technology, corporate development (including, without limitation, licenses, innovation, research or establishment of third party collaborations), manufacturing or process development, legal compliance or risk reduction, patent application or issuance goals, or goals relating to acquisitions, divestitures or other business combinations (in whole or in part), joint ventures or strategic alliances; and (xxx) other measures of performance selected by the board of directors.

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. Our board of directors is authorized at any time in its sole discretion, to adjust or modify the calculation of a performance goal for such performance period in order to prevent the dilution or enlargement of the rights of participants, (a) in the event of, or in anticipation of, any unusual or extraordinary corporate item, transaction, event or development; (b) in recognition of, or in anticipation of, any other unusual or nonrecurring events affecting the Company, or the financial statements of the Company in response to, or in anticipation of, changes in applicable laws, regulations, accounting principles, or business conditions; or (c) in view of the board of

director's assessment of the business strategy of the Company, performance of comparable organizations, economic and business conditions, and any other circumstances deemed relevant. Specifically, the board of directors is authorized to make adjustment in the method of calculating attainment of performance goals and objectives for a performance period as follows: (i) to exclude the dilutive effects of acquisitions or joint ventures; (ii) to assume that any business divested by the Company achieved performance objectives at targeted levels during the balance of a performance period following such divestiture; and (iii) to exclude the effect of any change in the outstanding shares of common stock of the Company 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. In addition, the board of directors is authorized to make adjustment in the method of calculating attainment of performance goals and objectives for a performance period as follows: (i) to exclude restructuring and/or other nonrecurring charges; (ii) to exclude exchange rate effects, as applicable, for non-U.S. dollar denominated net sales and operating earnings; (iii) to exclude the effects of changes to generally accepted accounting standards required by the Financial Accounting Standards Board; (iv) to exclude the effects of any items that are "unusual" in nature or occur "infrequently" as determined under generally accepted accounting principles; (v) to exclude the effects to any statutory adjustments to corporate tax rates; and (vi) to make other appropriate adjustments selected by the board of directors.

*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 there is a specified type of change in our capital structure, such as a stock split, reverse stock split, or recapitalization, appropriate adjustments will be made to (1) the class and maximum number of shares reserved for issuance under the 2018 Plan, (2) the class and maximum number of shares by which the share reserve may increase automatically each year, (3) the class and maximum number of shares that may be issued on the exercise of incentive stock options, (4) the class and maximum number of shares subject to stock awards that may be awarded to any non-employee director under the 2018 Plan, and (5) the class and number of shares and exercise price, strike price, or purchase price, if applicable, of all outstanding stock awards.

*Corporate Transactions.* Our 2018 Plan provides that in the event of certain specified significant corporate transactions (or a change in control, as defined below), unless otherwise provided in an award agreement or other written agreement between us and the award holder, the administrator may take one or more of the following actions with respect to such stock awards:

- arrange for the assumption, continuation, or substitution of a stock award by a successor corporation;
- arrange for the assignment of any reacquisition or repurchase rights held by us to a successor corporation;
- accelerate the vesting, in whole or in part, of the stock award and provide for its termination if not exercised (if applicable) at or before the effective time of the transaction;
- arrange for the lapse, in whole or in part, of any reacquisition or repurchase rights held by us;
- cancel or arrange for the cancellation of the stock award, to the extent not vested or not exercised before the effective time of the transaction, in exchange for a cash payment, if any, as determined by the board; or
- make a payment, in the form determined by our board of directors, equal to the excess, if any, of (A) the value of the property the participant would have received on exercise of the award immediately before the effective time of the transaction, over (B) any exercise price payable by the participant in connection with the exercise.

The plan administrator is not obligated to treat all stock awards or portions of stock awards, even those that are of the same type, in the same manner and is not obligated to treat all participants in the same manner.

Under the 2018 Plan, a corporate transaction is generally the consummation of: (1) a sale of all or substantially all of our assets, (2) the sale or disposition of more than 50% of our outstanding securities, (3) a merger or consolidation where we do not survive the transaction, or (4) a merger or consolidation where we do survive the transaction but the shares of our common stock outstanding immediately before such transaction are converted or exchanged into other property by virtue of the transaction.

In the event of a change in control, the board of directors may take any of the above-mentioned actions. Awards granted under the 2018 Plan will not receive automatic acceleration of vesting and exercisability in the event of a change in control, although this treatment may be provided for in an award agreement or other written agreement between the Company and the participant. Under the 2018 Plan, a change in control is generally (1) the acquisition by any person or company of more than 50% of the combined voting power of our then outstanding stock, (2) a merger, consolidation or similar transaction in which our stockholders immediately before the transaction do not own, directly or indirectly, more than 50% of the combined voting power of the surviving entity (or the parent of the surviving entity), (3) a sale, lease, exclusive license or other disposition of all or substantially all of our assets other than to an entity more than 50% of the combined voting power of which is owned by our stockholders, (4) a complete dissolution or liquidation of the Company, or (5) when a majority of our board of directors becomes comprised of individuals who were not serving on our board of directors on the date of the underwriting agreement related to this offering, or the incumbent board, or whose nomination, appointment, or election was not approved by a majority of the incumbent board still in office.

*Transferability.* Under the 2018 Plan, stock awards are generally not transferable other than by will or the laws of descent and distribution, or as otherwise permitted by our board of directors.

*Plan Amendment or Termination.* Our board of directors has the authority to amend, suspend, or terminate our 2018 Plan, provided that such action does not materially impair the existing rights of any participant without such participant's written consent. Certain material amendments also require the approval of our stockholders. No incentive stock options may be granted after the tenth anniversary of the date our board of directors adopted our 2018 Plan. No stock awards may be granted under our 2018 Plan while it is suspended or after it is terminated.

#### ***Amended and Restated 2006 Equity Compensation Plan***

Our board of directors adopted and our stockholders originally approved our 2006 Plan in September 2006, and it was subsequently amended and restated in September 2008 and most recently amended in March 2016. All references herein to our 2006 Plan shall be deemed to refer to our Amended and Restated 2006 Equity Compensation Plan, as amended, unless the context otherwise requires. Our 2006 Plan allows for the grant of ISOs to employees, including employees of any subsidiary, and for the grant of NSOs, stock appreciation rights, restricted stock awards and restricted stock units and other equity awards to employees, directors and consultants, including employees and consultants of our subsidiaries. As of June 30, 2018, there remained 83,505 shares of common stock available for the grant of awards under the 2006 Plan, and there were options to purchase 416,937 shares of common stock outstanding under the 2006 Plan.

Once our 2018 Plan becomes effective, no further grants will be made under our 2006 Plan. Any outstanding awards granted under our 2006 Plan will remain subject to the terms of our 2006 Plan and applicable award agreements.

*Authorized Shares.* The maximum number of shares of our common stock that may be issued under our 2006 Plan is 511,194 shares. Shares subject to stock awards granted under our 2006 Plan that expire, are forfeited, or terminate without being exercised in full do not reduce the number of shares available for issuance under our 2006 Plan.



*Plan Administration.* Our board of directors or a duly authorized committee of our board of directors administers our 2006 Plan. Our board of directors shall have the sole authority to (i) determine the individuals to whom grants shall be made under the 2006 Plan, (ii) determine the type, size and terms of the grants to be made to each such individual, (iii) determine the time when the grants will be made and the duration of any applicable exercise or restriction period, including the criteria for exercisability and the acceleration of exercisability, (iv) amend the terms of any previously issued grant, and (v) deal with any other matters arising under the 2006 Plan.

*Change of Control.* Our 2006 Plan provides that in the event of a change of control, all awards granted under the 2006 Plan shall become fully vested and exercisable (as applicable), unless the board of directors determines otherwise. In the event of a change of control, the administrator may take any of the following actions with respect to any or all outstanding awards: (i) determine that all outstanding options and stock appreciation rights that are not exercised shall be assumed by, or replaced with comparable options by the surviving corporation (or a parent or subsidiary of the surviving corporation), and other outstanding grants that remain in effect after the change of control shall be converted to similar grants of the surviving corporation (or a parent or subsidiary of the surviving corporation), (ii) require that grantees surrender their outstanding options and stock appreciation rights in exchange for one or more payments, in cash or Company stock as determined by the board of directors, in an amount, if any, equal to the amount by which the then fair market value of the shares of Company stock subject to the grantee's unexercised options and stock appreciation rights exceeds the exercise price or base amount of the options and stock appreciation rights, on such terms as the board of directors determines, or (iii) after giving grantees an opportunity to exercise their outstanding options and stock appreciation rights, terminate any or all unexercised options and stock appreciation rights at such time as the board of directors deems appropriate. Such assumption, surrender or termination shall take place as of the date of the change of control or such other date as the board of directors may specify.

Under the 2006 Plan, a change of control is generally (1) the acquisition by any person or company of more than 50% of the combined voting power of our then outstanding stock, (2) the consummation of a merger or consolidation with another corporation where our stockholders, immediately prior to the merger or consolidation, will not beneficially own, immediately after the merger or consolidation, shares entitling such stockholders to more than 50% of all votes to which all stockholders of the surviving corporation would be entitled in the election of directors, (3) the consummation of a sale or other disposition of all or substantially all of our assets, or (4) the consummation of a liquidation or dissolution.

*Transferability.* Under our 2006 Plan, awards are generally not transferable other than by will or the laws of descent and distribution or as otherwise permitted by the Board.

*Plan Amendment or Termination.* Our board of directors has the authority to amend, suspend, or terminate our 2006 Plan, although certain material amendments require the approval of our stockholders, and amendments that would materially impair the rights of any participant require the consent of that participant.

#### **2018 Employee Stock Purchase Plan**

Our board of directors adopted, and our stockholders approved, our 2018 ESPP in July 2018. The ESPP will become effective immediately prior to and contingent 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 for U.S. employees.

*Share Reserve.* Following this offering, the ESPP authorizes the issuance of 175,000 shares of our common stock under 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, beginning on January 1, 2019 (assuming the ESPP becomes effective in 2018) through January 1, 2028, by the lesser of (1) 1% of the total number of shares of our common stock outstanding on the last day of the calendar month before the date of the automatic increase, and (2) 220,000 shares; provided that before 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). As of the date hereof, no shares of our common stock have been purchased under the ESPP.

*Administration.* Our board of directors administers the ESPP and may delegate its 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 that is at least the lesser of (1) 85% of the fair market value of a share of our common stock on the first date of an offering, or (2) 85% of the fair market value of a share of our common stock on the date of purchase. For the initial offering, which we expect will commence on the execution and delivery of the underwriting agreement relating to this offering, the fair market value on the first day of the offering period will be the price at which shares of common stock are first sold to the public.

*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 calendar 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 under 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 class(es) and maximum number of shares reserved under the ESPP, (2) the class(es) and maximum number of shares by which the share reserve may increase automatically each year, (3) the class(es) and number of shares subject to and purchase price applicable to outstanding offerings and purchase rights, and (4) the class(es) and number of shares that are subject to purchase limits under ongoing offerings.

*Corporate Transactions.* In the event of certain significant corporate transactions, 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 before such corporate transaction, and such purchase rights will terminate immediately.

Under the ESPP, a corporate transaction is generally the consummation of: (1) a sale of all or substantially all of our assets, (2) the sale or disposition of more than 50% of our outstanding securities, (3) a merger or consolidation where we do not survive the transaction, and (4) a merger or consolidation where we do survive the transaction but the shares of our common stock outstanding immediately before such transaction are converted or exchanged into other property by virtue of the transaction,

*ESPP Amendment or 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.

#### **Limitations on Liability and Indemnification**

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 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 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 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, executive officers and other employees as determined by the board of directors. 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 any action or proceeding.

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 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.

**Rule 10b5-1 Sales Plans**

Our directors and officers may adopt written plans, known as Rule 10b5-1 plans, in which they will contract with a broker to buy or sell shares of our common stock on a periodic basis. Under a Rule 10b5-1 plan, a broker executes trades under parameters established by the director or officer when entering into the plan, without further direction from them. The director or officer may amend a Rule 10b5-1 plan in some circumstances and may terminate a plan at any time. Our directors and executive officers may also buy or sell additional shares outside of a Rule 10b5-1 plan when they do not possess of material nonpublic information, subject to compliance with the terms of our insider trading policy. During the first 180 days following this offering, the sale of any shares under such plan would be subject to the lock-up agreement that the director or officer has entered into with the underwriters.

## 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, 2015 to which we were a party or will be a party, in which:

- the amounts involved exceeded or will exceed \$120,000; and
- any of our directors, executive officers or holders of more than 5% of our capital stock, or any member of the immediate family of, or person sharing the household with, the foregoing persons, had or will have a direct or indirect material interest.

### Participation in this Offering

Certain of our existing stockholders and existing beneficial owners of more than 5% of our voting securities, including entities affiliated with them or with certain of our directors, have indicated an interest in purchasing an aggregate of approximately \$13.0 million in units in this offering at the initial public offering price per unit. Based on an initial public offering price of \$6.125 per unit, these persons and entities would purchase an aggregate of approximately 2,122,449 of the 3,360,000 units in this offering based on these indications of interest. However, because indications of interest are not binding agreements or commitments to purchase, the underwriters may determine to sell more, less or no units in this offering to any of these persons or entities, or any of these persons or entities may determine to purchase more, less or no units in this offering.

### Convertible Promissory Note Financing

In February 2016, we issued convertible promissory notes in the aggregate principal amount of \$1.5 million with an interest rate of 8% per annum. These convertible promissory notes provided for conversion into preferred shares in our next equity financing, at a rate equal to the principal amount of the convertible promissory notes and accrued interest thereon divided by the per share purchase price of the preferred shares in that financing. As further discussed below, on March 4, 2016, these convertible promissory notes converted into an aggregate of 3,138,013 shares of our Series D convertible preferred stock.

The participants in this note financing included the following members of our board of directors and holders of more than 5% of our outstanding capital stock:

<u>Name of Participant</u>	<u>Total Principal Amount</u>
Entities affiliated with LC Fund VI, L.P.(1)	\$ 750,000
Entities affiliated with Domain Partners VIII, L.P.(2)	\$ 750,000

(1) Includes (i) \$715,042 in cash from LC Fund VI, L.P. and (ii) \$34,958 in cash from LC Healthcare Fund I, L.P.

(2) Includes (i) \$744,476 in cash from Domain Partners VIII, L.P., and (ii) \$5,524 in cash from DP VIII Associates, L.P.

### Series D Convertible Preferred Stock and Warrant Financing

In March and April 2016, we issued and sold, in a series of closings, an aggregate of 20,652,486 shares of our Series D convertible preferred stock at a purchase price of \$0.48 per share for an aggregate purchase price of approximately \$9.9 million, and warrants to purchase an aggregate of 31,672,817 shares of our Series D convertible preferred stock for an aggregate purchase price of approximately \$31,673. In connection with the first closing of this financing in March 2016, an aggregate of approximately \$1.5 million in principal and accrued interest outstanding under the subordinated convertible promissory notes we issued in February 2016 converted into an aggregate of 3,138,013 shares of our Series D convertible preferred stock.

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All purchasers of our Series D convertible preferred stock are entitled to specified registration rights. See the section titled “Description of Securities—Registration Rights” for more information regarding these registration rights. The following table summarizes the Series D convertible preferred stock purchased by affiliates of our executive officers and of members of our board of directors and holders of more than 5% of our outstanding capital stock:

<u>Name of Participant</u>	<u>Shares of Series D Convertible Preferred Stock</u>	<u>Warrants to Purchase Shares of Series D Convertible Preferred Stock</u>	<u>Aggregate Purchase Price</u>
Entities affiliated with LC Fund VI, L.P. (1)	6,443,565	11,263,624	\$3,104,175
Entities affiliated with Domain Partners VIII, L.P.(2)	6,443,565	7,412,740	\$3,100,324
Han Cao	4,362,062	10,731,083	\$2,104,521
Novartis Bioventures Ltd.	1,615,096	—	\$ 775,246

- (1) Includes: (i) \$716,609 of unpaid principal and accrued interest and \$2,242,877 in cash from LC Fund VI, L.P., and (ii) \$35,035 of unpaid principal and accrued interest and \$109,654 in cash from LC Parallel Fund VI, L.P.
- (2) Includes: (i) \$749,045 of unpaid principal and accrued interest and \$2,328,444 in cash from Domain Partners VIII, L.P., and (ii) \$5,558 of unpaid principal and accrued interest and \$17,277 in cash from DP VIII Associates, L.P.

### **Series D-1 Convertible Preferred Stock Financing**

In August 2016, as well as January, February, March, April, May, July, August and November 2017, we issued and sold, in a series of closings, an aggregate of 66,141,257 shares of our Series D-1 convertible preferred stock at a purchase price of \$0.48 per share for an aggregate gross proceeds of approximately \$31.7 million. All purchasers of our Series D-1 convertible preferred stock are entitled to certain registration rights. See the section titled “Description of Securities—Registration Rights” for more information regarding these registration rights. The following table summarizes the Series D-1 convertible preferred stock purchased by affiliates of our executive officers and of members of our board of directors and holders of more than 5% of our outstanding capital stock:

<u>Name of Participant</u>	<u>Shares of Series D-1 Convertible Preferred Stock</u>	<u>Aggregate Purchase Price</u>
Entities affiliated with LC Fund VI, L.P.(1)	27,305,708	\$13,106,740
Praise Alliance International Limited	12,500,000	\$ 6,000,000
Full Succeed International Limited	10,416,667	\$ 5,000,000
Entities affiliated with Domain Partners VIII, L.P.(2)	3,710,247	\$ 1,780,918
Novartis Bioventures Ltd.	1,070,373	\$ 513,779
Han Cao	104,167	\$ 50,000

- (1) Includes (i) \$1,883,867 in cash from LC Fund VI, L.P.; (ii) \$11,106,738 in cash from LC Healthcare Fund I, L.P.; and (iii) \$116,135 in cash from LC Parallel Fund VI, L.P.
- (2) Includes (i) \$1,767,801 in cash from Domain Partners VIII, L.P., and (ii) \$13,117 in cash from DP VIII Associates, L.P.

### **Convertible Promissory Note Financing**

In February 2018, we issued convertible promissory notes in the aggregate principal amount of approximately \$13.4 million with an interest rate of 8% per annum. These convertible promissory notes provide for conversion under the following three circumstances:

Conversion at Qualifying financing – Upon the closing of an equity financing involving the sale by us of convertible preferred stock in which we receive an aggregate of at least \$15,000,000 in cumulative gross

proceeds, the conversion price will equal 75% of the lowest per share cash purchase price of the convertible preferred stock sold by us in such qualified financing. The original principal amount and accrued interest under each convertible promissory note shall automatically convert into convertible preferred stock.

Conversion at Initial Public Offering – Prior to the maturity date of the convertible promissory notes, if we complete our initial public offering, the convertible promissory notes will automatically convert into shares of our common stock at an amount equal to the original principal amount and accrued interest under each convertible promissory note divided by 75% of either the per share cash purchase price of the common stock offered to the public in the initial public offering or the per unit cash purchase price of the units offered to the public in the initial public offering, as applicable.

Optional Conversion at Maturity – Upon maturity, and at the election of the holder, the convertible promissory notes will convert into shares of Series D-2 convertible preferred stock as is equal to the original principal amount and accrued interest under each convertible promissory note divided by the price per share. The price per share is defined as \$60,000,000 divided by the aggregate number of outstanding shares of our common stock as of the maturity date.

Accordingly, in connection with the completion of our initial public offering, the principal amount of the convertible promissory notes and accrued interest thereon will automatically convert into 3,203,107 shares of our common stock, assuming the initial public offering price of \$6.125 per unit and a conversion date of June 30, 2018.

The participants in this note financing included the following members of our board of directors and holders of more than 5% of our outstanding capital stock:

<u>Name of Participant</u>	<u>Total Principal Amount</u>
Entities affiliated with LC Fund VI, L.P. (1)	\$ 8,460,000
Entities affiliated with Domain Partners VIII, L.P.(2)	\$ 1,500,000

- (1) Includes (i) \$3,460,000 in cash from LC Healthcare Fund I, L.P.; and (ii) \$5,000,000 cash from Rosy Shine Limited.  
(2) Includes (i) \$1,488,952 in cash from Domain Partners VIII, L.P., and (ii) \$11,048 in cash from DP VIII Associates, L.P.

One of our directors, Junfeng Wang, is affiliated with LC Fund VI, L.P. (and its affiliated entities that participated in the financings described above).

#### **Investors' Rights Agreement**

In August 2016, we entered into a fifth amended and restated investors' rights agreement, or the IRA, with certain holders of our preferred stock and common stock, including entities affiliated with LC Fund VI, L.P. and Domain Partners VIII, L.P. and including certain members of, and affiliates of, our directors and certain of our executive officers. The IRA provides the holders of our 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 Company has obtained a waiver of these rights in connection with the S-1. 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 shall terminate immediately prior to, but subject to, the consummation of this firm-commitment underwritten public offering pursuant to the registration statement of which this prospectus forms a part. After 12 months following the closing of this offering, the holders of 4,948,360 shares of our common stock issuable upon conversion of outstanding preferred stock will be entitled to rights with respect to the registration of their shares of common stock under the Securities Act under this agreement. For a description of these registration rights, see "Description of Securities—Registration Rights."

**Indemnification Agreements**

Our amended and restated certificate of incorporation will contain provisions limiting the liability of directors, and our amended and restated bylaws 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 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 “Executive Compensation—Limitations on Liability and Indemnification Matters.”

**Policies and Procedures for Transactions with Related Persons**

Prior to completion of this offering, we intend to adopt a written policy that our executive officers, directors, nominees for election as a director, beneficial owners of more than 5% of any class of our common stock and any members of the immediate family of any of the foregoing persons are not permitted to enter into a related person transaction with us without the approval or ratification of our board of directors or our audit committee. Any request for us to enter into a transaction with an executive officer, director, nominee for election as a director, beneficial owner of more than 5% of any class of our common stock, or any member of the immediate family of any of the foregoing persons, in which the amount involved exceeds \$120,000 and such person would have a direct or indirect interest, must be presented to our board of directors or our audit committee for review, consideration and approval. In approving or rejecting any such proposal, our board of directors or our audit committee is to consider the material facts of the transaction, including whether the transaction is on terms no less favorable than terms generally available to an unaffiliated third party under the same or similar circumstances and the extent of the related person’s interest in the transaction.



## PRINCIPAL STOCKHOLDERS

The following table sets forth information regarding beneficial ownership of our capital stock by:

- each person, or group of affiliated persons, known by us to beneficially own more than 5% of our common stock;
- each of our directors;
- each our of named executive officers; and
- all of our current executive officers and directors as a group.

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.

The percentage ownership information under the column entitled “Before Offering” is based on 2,928,325 shares of our common stock outstanding as of June 30, 2018, which gives effect to the conversion of all outstanding shares of our convertible preferred stock into 2,850,280 shares of common stock.

The percentage ownership information under the column entitled “After Offering” is based on the sale of 3,360,000 units in this offering, assuming (i) no exercise of the underwriters’ option to purchase additional shares, and (ii) the conversion of approximately \$14.4 million aggregate principal amount of outstanding convertible promissory notes plus accrued interest thereon into 3,203,107 shares of common stock (based on the initial public offering price of \$6.125 per unit and a conversion date of June 30, 2018). The table does not include the shares of common stock issuable upon the exercise of the warrants included in the units to be sold in the offering.

Information with respect to beneficial ownership has been furnished by each director, officer or beneficial owner of more than 5% of our common stock. We have determined beneficial ownership in accordance with the rules of the SEC. These rules generally attribute beneficial ownership of securities to persons who possess sole or shared voting power or investment power with respect to those securities. In addition, the rules include shares of our common stock issuable pursuant to the exercise of stock options or warrants that are either immediately exercisable or exercisable within 60 days after June 30, 2018. These shares are deemed to be outstanding and beneficially owned by the person holding those options or warrants for the purpose of computing the percentage ownership of that person, but they are not treated as outstanding for the purpose of computing the percentage ownership of any other person. Unless otherwise indicated, the persons or entities identified in this table have sole voting and investment power with respect to all shares shown as beneficially owned by them, subject to applicable community property laws.

Certain of our existing stockholders, including entities affiliated with them or with certain of our directors, have indicated an interest in purchasing an aggregate of approximately \$13.0 million in units in this offering at the initial public offering price per unit. Based on an initial public offering price of \$6.125 per unit, these persons and entities would purchase an aggregate of approximately 2,122,449 of the 3,360,000 units in this offering based on these indications of interest. However, because indications of interest are not binding agreements or commitments to purchase, the underwriters may determine to sell more, less or no units in this offering to any of these persons or entities, or any of these persons or entities may determine to purchase more, less or no units in this offering. The following table does not reflect any potential purchases by these persons or entities or their affiliated entities, nor does it give effect to any units that may be acquired by our stockholders, directors or executive officers pursuant to the reserved share program.

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Unless otherwise indicated, the address for each beneficial owner listed in the table below is c/o Bionano Genomics, Inc., 9640 Towne Centre Drive, Suite 100, San Diego, California 92121.

Name of Beneficial Owner	Number of Shares Beneficially Owned Before the Offering	Number of Shares Beneficially Owned After the Offering	Percentage of Shares Beneficially Owned	
			Before Offering	After Offering
<b>Greater than 5% Stockholders</b>				
Entities affiliated with LC Fund VI, L.P.(1)	1,251,355	2,885,521	39.2%	30.4%
Entities affiliated with Domain Partners VIII, L.P.(2)	806,884	932,116	25.7%	9.8%
ETP Global Fund, LP(3)	—	672,814	*	7.1%
<b>Directors and Named Executive Officers</b>				
David L. Barker, Ph.D.(4)	8,536	8,536	*	*
Darren Cai, Ph.D.	—	—	*	*
Han Cao, Ph.D.(5)	402,015	151,289	12.5%	1.6%
R. Erik Holmlin, Ph.D.(6)	107,041	107,041	3.5%	1.1%
Albert Luderer, Ph.D.(7)	5,861	5,861	*	*
Christopher Twomey	—	—	*	*
Junfeng Wang(1)	1,252,736	2,886,902	39.2%	30.4%
Mike Ward(8)	22,887	22,887	*	*
Quan Zhou(1)	1,252,736	2,886,902	39.2%	30.4%
All directors and executive officers as a group (11 persons)(9)	1,840,936	3,224,376	50.2%	33.2%

\* Represents beneficial ownership of less than 1%.

- (1) Consists of (i) 426,900 shares of common stock and 250,902 shares of common stock issuable upon the exercise of warrants held by LC Fund VI, L.P., (ii) 20,656 shares of common stock and 12,266 shares of common stock issuable upon the exercise of warrants held by LC Parallel Fund VI, L.P. and (iii) 540,631 shares of common stock held by LC Healthcare Fund I, L.P. The number of shares beneficially owned after the offering includes an aggregate of 1,897,334 shares of our common stock issuable upon the automatic conversion of (a) \$3,460,000 of outstanding principal, plus accrued interest thereon, underlying a convertible promissory note held by LC Healthcare Fund I, L.P. and (b) \$5,000,000 of outstanding principal, plus accrued interest thereon, underlying a convertible promissory note held by Rosy Shine Limited, upon the completion of this offering at an initial public offering price of \$6.125 per unit, assuming a conversion date of June 30, 2018. Each of LC Fund VI, L.P., LC Parallel Fund VI, L.P., and LC Healthcare Fund I, L.P., collectively referred to as the LC Funds, are ultimately controlled and managed by Legend Capital, a limited liability Chinese company. Legend Capital is ultimately controlled by a management team consisting of three key individuals, Linan Zhu, Hao Chen, and Nengguang Wang. In addition, Junfeng Wang is a Managing Director of Legend Capital. Each of these individual managers of Legend Capital shares voting and investment power over the shares held by the LC Funds and each disclaims beneficial ownership of all shares held by Legend Capital, except to the extent of each such member's actual pecuniary interest therein. Rosy Shine Limited is ultimately controlled and managed by Legend Holdings, a limited liability Chinese joint stock company listed on a Stock Exchange of Hong Kong (3396), which is controlled by its board of directors. The board of directors of Legend Holdings has sole voting and investment power over the shares held by Rosy Shine Limited. None of the members of the board of directors has individual voting or investment power with respect to such shares and each disclaims beneficial ownership of such shares. The address of the each of the above entities is Legend Capital, 10F, Tower A, Raycom Infotech Park, No.2, Kexueyuan South Road, Zhongguancun, Haidian District, Beijing 100190 PRC.
- (2) Consists of (i) 591,184 shares of common stock and 209,620 shares of common stock issuable upon the exercise of warrants held by Domain Partners VIII, L.P., (ii) 4,386 shares of common stock and 1,554 shares of common stock issuable upon the exercise of the warrants held by DP VIII Associates, L.P. and (iii) 140 shares of common stock held by Domain Associates, L.L.C. The number of shares beneficially owned after

the offering includes an aggregate of 336,406 shares of our common stock issuable upon the automatic conversion of \$1,500,000 of outstanding principal plus accrued interest underlying convertible notes held by Domain Partners VIII, L.P. and DP VIII Associates, L.P., upon the completion of this offering at an initial public offering price of \$6.125 per unit, and assuming the occurrence of the conversion on June 30, 2018. James C. Blair, Brian H. Dovey, Brian K. Halak, Jesse I. Treu and Nicole Vitullo, the managing members of One Palmer Square VIII, L.L.C., share voting and investment power over the shares held by Domain Partners VIII, L.P. and DP VIII Associates, L.P. James C. Blair, Brian H. Dovey, Brian K. Halak, Nicole Vitullo, and Kim P. Kamdar, the managing members of Domain Associates, L.L.C., share voting and investment power over the shares held by Domain Associates, L.L.C. Each managing member of One Palmer Square VIII, L.L.C. and Domain Associates, L.L.C. disclaims beneficial ownership of all shares held by the Domain Entities, except to the extent of each such managing member's actual pecuniary interest therein. The address for the Domain Entities is One Palmer Square, Suite 515, Princeton, NJ 08542.

- (3) The number of shares beneficially owned after the offering includes an aggregate of 672,814 shares of our common stock issuable upon the automatic conversion of \$3,000,000 of outstanding principal plus accrued interest underlying convertible notes held by ETP Global Fund, LP upon the completion of this offering at an initial public offering price of \$6.125 per unit and assuming the occurrence of the conversion on June 30, 2018. ETP Global Fund, LP, or ETP Global, is a limited partnership organized under the laws of the State of Delaware. Emerging Technology Partners LLC is the general partner of ETP Global, and Wei-Wu He is its managing member, who exercises sole voting and investment power over the shares held by ETP Global. Wei-Wu He disclaims beneficial ownership of the shares held by ETP Global, except to the extent of his pecuniary interest therein. The registered address of ETP Global and Emerging Technology Partners LLC is 4919 Rebel Ridge Dr., Sugarland, TX 77478.
- (4) Consists of 8,536 shares of common stock subject to options exercisable as of August 29, 2018.
- (5) Consists of 112,936 shares of common stock, 250,726 shares of common stock issuable upon the exercise of warrants and 38,353 shares of common stock subject to options exercisable as of August 29, 2018.
- (6) Consists of 107,041 shares of common stock subject to options exercisable as of August 29, 2018.
- (7) Consists of 5,861 shares of common stock subject to options exercisable as of August 29, 2018.
- (8) Consists of 22,887 shares of common stock subject to options exercisable as of August 29, 2018.
- (9) Consists of the shares identified in footnotes (1), (4), (5), (6), (7) and (8), and 41,860 shares of common stock subject to options exercisable as of August 29, 2018.

## DESCRIPTION OF SECURITIES

### General

Upon filing of our amended and restated certificate of incorporation and the completion of this offering, our authorized capital stock will consist of 200,000,000 shares of common stock, par value \$0.0001 per share, and 10,000,000 shares of preferred stock, par value \$0.0001 per share. All of our authorized preferred stock upon the completion of this offering will be undesignated. The following is a summary of the rights of our common and preferred stockholders and some of the provisions of our amended and restated certificate of incorporation and amended and restated bylaws, which will become effective immediately prior to and upon the completion of this offering, respectively, and of the Delaware General Corporation Law. This summary is not complete. For more detailed information, please see our amended and restated certificate of incorporation and amended and restated bylaws, which are filed as exhibits to the registration statement of which this prospectus is a part, as well as the relevant provisions of the Delaware General Corporation Law.

### Units

Each unit offered consists of one share of our common stock and one warrant to purchase one share of our common stock. We anticipate that the units will begin trading on or promptly after the date of this prospectus. The units will automatically separate 30 days after the date of this prospectus, and the shares of common stock and the warrants underlying the units will begin trading separately, unless Roth Capital Partners, LLC, as the representative of the underwriters, determines that an earlier date is acceptable (based upon, among other things, its assessment of the relative strengths of the securities markets and small capitalization companies in general, and the trading pattern of, and demand for, our securities in particular). If Roth Capital Partners, LLC permits separate trading of our common stock and warrants prior to September 21, 2018, we will issue a press release and file a Current Report on Form 8-K with the SEC announcing when such separate trading will begin.

### Common Stock

#### *Outstanding Shares*

As of June 30, 2018, there were 78,045 shares of common stock issued and outstanding held of record by 86 stockholders. This amount excludes our outstanding shares of convertible preferred stock, which will convert into 2,850,280 shares of common stock in connection with the closing of this offering. Based on the number of shares of common stock outstanding as of June 30, 2018, and assuming (i) the automatic conversion of all of our outstanding shares of convertible preferred stock into an aggregate of 2,850,280 shares of common stock, (ii) the conversion of approximately \$14.4 million aggregate principal amount of outstanding convertible promissory notes plus accrued interest thereon into 3,203,107 shares of common stock (based on the initial public offering price of \$6.125 per unit and a conversion date of June 30, 2018), and (iv) the issuance by us of 3,360,000 units in this offering, there will be 9,491,432 shares of common stock outstanding upon the completion of this offering (including shares of common stock included in the units but excluding shares underlying the warrants included in the units).

#### *Voting Rights*

Our common stock is entitled to one vote for each share held of record on all matters submitted to a vote of the stockholders, including the election of directors, and does not have cumulative voting rights. Our amended and restated certificate of incorporation establishes a classified board of directors that is divided into three classes with staggered three-year terms. Only the directors in one class will be subject to election by a plurality of the votes cast at each annual meeting of our stockholders, with the directors in the other classes continuing for the remainder of their respective three-year terms.

***Economic Rights***

Except as otherwise expressly provided in our eighth amended and restated certificate of incorporation or required by applicable law, all shares of common stock will have the same rights and privileges and rank equally, share ratably, and be identical in all respects for all matters, including those described below.

*Dividends.* Subject to preferences that may be applicable to any then-outstanding preferred stock, the holders of common stock are entitled to receive dividends, if any, as may be declared from time to time by our board of directors out of legally available funds.

*Liquidation Rights.* In the event of our liquidation, dissolution or winding-up, holders of our common stock will be entitled to share ratably in the net assets legally available for distribution to stockholders after the payment of all of our debts and other liabilities, subject to the satisfaction of any liquidation preference granted to the holders of any outstanding shares of preferred stock.

***No Preemptive or Similar Rights***

The holders of our shares of common stock are not entitled to preemptive rights, and are not subject to conversion, redemption or sinking fund provisions. The rights, preferences and privileges of the holders of our common stock are subject to, and may be adversely affected by, the rights of the holders of shares of any series of our preferred stock that we may designate and issue in the future.

***Fully Paid and Non-Assessable***

All of our outstanding shares of common stock are, and the shares of common stock forming part of the units to be issued in this offering will be, fully paid and nonassessable.

**Convertible Preferred Stock**

As of June 30, 2018, there were 121,992,497 shares of our convertible preferred stock outstanding, held of record by 22 holders. Immediately prior to the closing of this offering, each 42.8 outstanding shares of our preferred stock will convert into one share of our common stock. In addition, immediately prior to the completion of this offering, our certificate of incorporation will be amended and restated to delete all references to such shares of convertible preferred stock. Under this amended and restated certificate of incorporation, our board of directors will have the authority, without further action by our stockholders, to issue up to 10,000,000 shares of convertible preferred stock in one or more series, to establish from time to time the number of shares to be included in each such series, to fix the rights, preferences and privileges of the shares of each wholly unissued series and any qualifications, limitations or restrictions thereon and to increase or decrease the number of shares of any such series, but not below the number of shares of such series then outstanding.

Our board of directors may authorize the issuance of preferred stock with voting or conversion rights that could adversely affect the voting power or other rights of the holders of the common stock. The issuance of preferred stock, while providing flexibility in connection with possible acquisitions and other corporate purposes, could, among other things, have the effect of delaying, deferring or preventing a change in our control that may otherwise benefit holders of our common stock and may adversely affect the market price of the common stock and the voting and other rights of the holders of common stock. We have no current plans to issue any shares of preferred stock.

**Warrants Issued as Part of the Units**

Each warrant underlying a unit entitles the holder to purchase one share of our common stock at an initial exercise price of \$6.125, or 100% of the initial public offering price per unit, subject to adjustment. Each warrant

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will be exercisable 30 days after the date of this prospectus, or the date on which Roth Capital Partners, LLC, as the representative of the underwriters, separates the units, whichever date is earlier and will expire at 5:00 p.m. New York City time on August 21, 2023.

The warrants will be issued in registered form, in each case pursuant to a warrant agreement between American Stock Transfer & Trust Company, LLC, as warrant agent, and us.

Our warrants have been approved for listing on Nasdaq under the symbol “BNGOW.”

The exercise price and number of shares issuable upon exercise of the warrants may be adjusted upon the occurrence of certain events, including but not limited to any stock split, stock dividend, extraordinary dividend, recapitalization, reorganization, merger or consolidation. However, the warrants will not be adjusted for issuances of common stock or securities convertible or exercisable into common stock at a price below the then current exercise price of such warrant.

If, at any time warrants are outstanding, we consummate any fundamental transaction, as described in such warrants and generally including any consolidation or merger with or into another corporation, the consummation of a transaction whereby another entity acquires more than 50% of our outstanding common stock, or the sale or other disposition of all or substantially all of our assets, or other transaction in which our common stock are converted into or exchanged for other securities or other consideration, the holder of any such warrants will thereafter receive upon exercise of such warrants, the securities or other consideration to which a holder of the number of common stock then deliverable upon the exercise or conversion of such warrants would have been entitled upon such consolidation or merger or other transaction.

The number of shares of our common stock that may be acquired by any holder upon any exercise of the warrants will be limited to the extent necessary to insure that, following such exercise (or other issuance), the total number of common stock then beneficially owned by such holder and its affiliates and any other persons whose beneficial ownership of common stock would be aggregated with the holder's for purposes of Section 13(d) of the Securities Exchange Act of 1934, as amended, does not exceed 9.99% (or in certain instances 4.99%) of the total number of issued and outstanding shares of our common stock (including for such purpose the common stock issuable upon such exercise), which we refer to as the beneficial ownership limitation; provided, however, that if a holder and/or its affiliates already own 9.99% (or 4.99%, as applicable) on the date of this offering then the beneficial ownership limitation will not apply to such holder. A holder may elect to increase or decrease this beneficial ownership limitation from 9.99% (or 4.99%, as applicable) to any other percentage of the total number of issued and outstanding shares of our common stock (including for such purpose the common stock issuable upon such exercise) upon providing us with not less than 61 days' prior written notice, and any such increase will apply only to such holder.

The warrants may be exercised, at the option of each holder, in whole or in part, upon surrender of the warrant certificate on or prior to the expiration date at the offices of the warrant agent, with the exercise form on the reverse side of the warrant certificate completed and executed as indicated, accompanied by full payment of the exercise price for the number of common stock purchased upon such exercise, by certified check payable to us or by wire transfer of immediately available funds to an account designated by us. Subject to applicable laws, the warrants may be transferred at the option of the holders upon surrender of the warrants to us together with the appropriate instruments of transfer.

The warrant holders will not have the rights or privileges of holders of common stock and any voting rights until they exercise their warrants and receive common stock. After the issuance of common stock upon exercise of such warrants, each holder will be entitled to one vote for each common stock held of record on all matters to be voted on by stockholders. If we fail to issue a holder of our warrants, within three business days after receipt of an applicable exercise notice, a certificate for the number of shares of our common stock to which such holder is entitled, then such holder can rescind the exercise of such warrant. If we are otherwise unable to issue and

deliver the number of shares of our common stock that a holder is entitled to under the warrant, we have no obligation to pay such holder any cash or other consideration to settle such warrant.

Under the terms of the warrant agreement, we have agreed to use our reasonable best efforts to maintain the effectiveness of the registration statement and current prospectus relating to common stock issuable upon exercise of the warrants at any time that the warrants are exercisable. During any period that we fail to have maintained an effective registration statement covering the common stock underlying such warrants, the holder may exercise such warrants on a cashless basis.

### **Stock Options**

As of June 30, 2018, 416,937 shares of common stock were issuable upon the exercise of outstanding stock options, at a weighted-average exercise price of \$5.05 per share.

### **Warrants**

As of June 30, 2018, the following shares of our convertible preferred stock were issuable upon the exercise of outstanding warrants:

- A warrant to purchase 42,872 shares of Series B convertible preferred stock for an exercise price of \$1.3995 per share, which we issued to Square 1 Bank.
- Warrants to purchase an aggregate of 75,027 shares of Series B-1 convertible preferred stock for an exercise price of \$1.3995 per share, which we issued to Square 1 Bank.
- Warrants to purchase an aggregate of 4,010,757 shares of Series B-1 convertible preferred stock for an exercise price of \$1.3995 per share, which we issued to investors in connection with a series of financing transactions.
- A warrant to purchase 510,417 shares of Series D convertible preferred stock for an exercise price of \$0.48 per share, which we issued to Western Alliance Bank.
- Warrants to purchase an aggregate of 31,672,817 shares of Series D convertible preferred stock for an exercise price of \$0.41 per share, which we issued to investors in connection with a financing transaction.
- A warrant to purchase 291,667 shares of Series D-1 convertible preferred stock for an exercise price of \$0.48 per share, which we issued to Western Alliance Bank.
- A warrant to purchase 625,000 shares of Series D-1 convertible preferred stock for an exercise price of \$0.48 per share, which we issued to Midcap Financial Trust.

Each of the foregoing warrants provide for the adjustment of the number of shares issuable upon the exercise thereof in the event of stock splits, recapitalizations, reclassifications and consolidations. In addition, the warrants to purchase shares of Series B-1 convertible preferred stock and Series D convertible preferred stock that we issued in connection with our financing transactions contain provisions that provide for the automatic net exercise of such warrants upon the closing of this offering.

### **Registration Rights**

We are party to a fifth amended and restated investors' rights agreement, dated August 5, 2016, pursuant to which certain holders of our capital stock, or their transferees, are entitled to 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 are obligated to pay the registration expenses, other

than underwriting discounts and selling commissions, of the shares registered by the demand, piggyback and Form S-3 registrations 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 on the fifth anniversary of the date of a qualified public offering, a deemed liquidation event, or with respect to any particular holder of registrable securities, such time after this offering that the holder can sell all of its registrable securities without restriction under Rule 144 of the Securities Act during any three month period.

#### ***Demand Registration Rights***

Any time after the earlier of (i) 12 months following the effective date of a qualified public offering and (ii) August 5, 2020, the holders of at least 66-2/3% of the shares of our outstanding preferred stock (or shares of our common stock issued upon conversion of the shares of such preferred stock, or a combination thereof) may request that we file a registration statement covering all or any portion of the registrable securities held by them, subject to the requirement that the registration must cover at least 20% of the registrable securities then held by them, or a lesser percentage if the anticipated gross receipts from the offering would exceed \$40,000,000. The holders of our convertible preferred stock may not request more than two registration statements which are declared effective. We are not obligated to effect a demand registration (i) during the period within 90 days after the effective date of a registration statement filed pursuant to a demand registration, (ii) if the registrable securities can be immediately registered on Form S-3, (iii) or during the 12 month period after the effective date of this registration statement.

In addition, the warrants to purchase our Series B and B-1 convertible preferred stock that we issued to Square 1 Bank provide for the same demand registration rights as described above.

#### ***Piggyback Registration Rights***

If we register any securities for public sale, holders of registration rights have the right to include their shares in the registration statement. As a result, whenever we propose to file a registration statement under the Securities Act, other than with respect to registration statements on Forms S-4, S-8, or another form not available for registering the registrable securities for sale to the public, 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.

In addition, the warrants to purchase our Series B, B-1, D and D-1 convertible preferred stock that we issued to Square 1 Bank, Western Alliance Bank and Midcap Financial Trust provide for the same piggyback registration rights as described above.

#### ***Form S-3 Registration Rights***

If we are eligible to file a registration statement on Form S-3, holders of registrable securities will have the right to demand that we file a registration statement on Form S-3 so long as the aggregate price to the public of the securities to be sold under the registration statement on Form S-3 is at least \$3.0 million, subject to specified exceptions, conditions and limitations. There is no limitation on the number of Form S-3 demand registrations that may be requested.

In addition, the warrants to purchase our Series B and B-1 convertible preferred stock that we issued to Square 1 Bank provide for the same Form S-3 registration rights as described above.

#### **Anti-Takeover Provisions**

The provisions of Delaware law, our eighth amended and restated certificate of incorporation and our amended and restated bylaws, which are summarized below, may have the effect of delaying, deferring or



discouraging another person from acquiring control of our company. They are also designed, in part, to encourage persons seeking to acquire control of us to negotiate first with our board of directors. We believe that the benefits of increased protection of our potential ability to negotiate with an unfriendly or unsolicited acquirer outweigh the disadvantages of discouraging a proposal to acquire us because negotiation of these proposals could result in an improvement of their terms.

***Certificate of Incorporation and Bylaws to be in Effect upon the Closing of this Offering***

Because our stockholders do not have cumulative voting rights, stockholders holding a majority of the voting power of our shares of common stock will be able to elect all of our directors. Our amended and restated certificate of incorporation and amended and restated bylaws to be effective upon the closing of this offering will provide for stockholder actions at a duly called meeting of stockholders or, before the date on which all shares of common stock convert into a single class, by written consent. A special meeting of stockholders may be called by a majority of our board of directors, the chair of our board of directors, or our chief executive officer. Our amended and restated bylaws will establish an advance notice procedure for stockholder proposals to be brought before an annual meeting of our stockholders, including proposed nominations of persons for election to our board of directors.

As described above in “Management— Composition of Our Board of Directors,” in accordance with our amended and restated certificate of incorporation to be filed in connection with this offering, immediately after this offering, our board of directors will be divided into three classes with staggered three-year terms.

The foregoing provisions will make it more difficult for another party to obtain control of us by replacing our board of directors. Since our board of directors has the power to retain and discharge our officers, these provisions could also make it more difficult for existing stockholders or another party to effect a change in management. In addition, the authorization of undesignated preferred stock makes it possible for our board of directors to issue preferred stock with voting or other rights or preferences that could impede the success of any attempt to change our control.

These provisions are designed to reduce our vulnerability to an unsolicited acquisition proposal and to discourage certain tactics that may be used in proxy fights. However, such provisions could have the effect of discouraging others from making tender offers for our shares and may have the effect of deterring hostile takeovers or delaying changes in our control or management. As a consequence, these provisions may also inhibit fluctuations in the market price of our stock that could result from actual or rumored takeover attempts.

***Section 203 of the Delaware General Corporation Law***

When we have a class of voting stock that is either listed on a national securities exchange or held of record by more than 2,000 stockholders, we will be subject to Section 203 of the Delaware General Corporation Law, which prohibits a Delaware corporation from engaging in any business combination with any interested stockholder for a period of three years after the date that such stockholder became an interested stockholder, subject to certain exceptions.

**Choice of Forum**

Our amended and restated certificate of incorporation provides that the Court of Chancery of the State of Delaware will be the exclusive forum for: (i) any derivative action or proceeding brought on our behalf; (ii) any action asserting a breach of fiduciary duty; (iii) any action asserting a claim against us or any of our directors or officers or other employees arising under the Delaware General Corporation Law, our amended and restated certificate of incorporation or our amended and restated bylaws; or (iv) any action asserting a claim against us that is governed by the internal affairs doctrine. Our amended and restated certificate of incorporation further provides that U.S. federal district courts will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act.

**Limitations on Liability and Indemnification**

See “Executive Compensation—Limitations on Liability and Indemnification.”

**Exchange Listing**

Our units, common stock and warrants have been approved for listing on the Nasdaq Stock Market LLC under the symbols “BNGOU,” “BNGO” and “BNGOW,” respectively.

**Transfer Agent and, Registrar and Warrant Agent**

The transfer agent and registrar for our common stock and the warrants agent for the warrants included in the units offered hereby is American Stock Transfer & Trust Company, LLC. Its address is 6201 15th Avenue, Brooklyn, New York 11219.

## SHARES ELIGIBLE FOR FUTURE SALE

Before the completion of this offering, there has been no public market for our securities. Future sales of substantial amounts of our securities, including shares issued on the exercise of outstanding warrants or options, in the public market after this offering, or the possibility of these sales or issuances occurring, could adversely affect the prevailing market price for our securities or impair our ability to raise equity capital.

Based on our shares outstanding as of June 30, 2018, upon the completion of this offering, a total of 9,491,432 shares of common stock will be outstanding (including shares of common stock included in the units but excluding shares underlying the warrants included in the units). Of these shares, all of the common stock sold in this offering by us, plus any shares sold by us on exercise of the underwriters' option to purchase additional common stock, will be freely tradable in the public market without restriction or further registration under the Securities Act, unless these shares are held by "affiliates," as that term is defined in Rule 144 under the Securities Act.

The remaining securities will be, and shares of common stock subject to stock options will be on issuance, "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 Rules 144 or 701 under the Securities Act, which are summarized below. Restricted securities may also be sold outside of the U.S. to non-U.S. persons in accordance with Rule 904 of Regulation S.

Subject to the lock-up agreements described below and the provisions of Rule 144 or Regulation S under the Securities Act, as well as our insider trading policy, these restricted securities will be available for sale in the public market after the date of this prospectus.

### 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 below.

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 below. Beginning 90 days after the date of this prospectus upon the expiration of such lock-up agreements, 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 common stock then outstanding, which will equal approximately 94,915 shares immediately after this offering, assuming no exercise of the underwriters' option to purchase additional units from us; or
- the average weekly trading volume of 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 below.

### **Form S-8 Registration Statements**

We intend to file one or more registration statements on Form S-8 under the Securities Act with the SEC to register the offer and sale of shares of our common stock that are issuable under our 2006 Plan, 2018 Plan and ESPP. These registration statements will become effective immediately on filing. Shares covered by these registration statements will then be eligible for sale in the public markets, subject to vesting restrictions, any applicable lock-up agreements described below, and Rule 144 limitations applicable to affiliates.

### **Lock-up Arrangements**

We, and all of our directors, executive officers and the holders of substantially all of our common stock and securities exercisable for or convertible into our common stock outstanding immediately on the closing of this offering, have agreed with the underwriters that, until 180 days (except for our chief executive officer, who has agreed to 18 months) after the date of the underwriting agreement related to this offering, we and they will not, without the prior written consent of Roth Capital Partners, directly or indirectly, 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 or otherwise transfer or dispose of any of our shares of common stock, or any securities convertible into or exercisable or exchangeable for shares of our common stock, or enter into any swap or any other agreement or any transaction that transfers, in whole or in part, directly or indirectly, the economic consequence of ownership of the securities, whether any such swap or transaction is to be settled by delivery of our common stock or other securities, in cash or otherwise. These agreements are described in "Underwriting." Roth Capital Partners may, in its sole discretion, release any of the securities subject to these lock-up agreements at any time.

### **Registration Rights**

Upon the closing of this offering, pursuant to our fifth amended and restated investors' rights agreement, the holders of 3,930,573 shares of our common stock, or their transferees, will be entitled to certain rights with respect to the registration of the offer and sale of their shares under the Securities Act, subject to the terms of the lock-up agreements described under "—Lock-Up Agreements" above. Registration of these shares under the Securities Act would result in the shares becoming freely tradable without restriction under the Securities Act immediately on the effectiveness of the registration. Any sales of securities by these stockholders could have a material adverse effect on the trading price of our common stock. See "Description of Securities Registration Rights" for additional information.

## **MATERIAL U.S. FEDERAL INCOME TAX CONSEQUENCES**

The following is a general discussion of the material U.S. federal income considerations relating to the purchase, ownership and disposition of our units comprised of our common stock and warrants exercisable for shares of our common stock, which we refer to collectively in this summary as our securities, purchased pursuant to this

offering. This discussion is based on current provisions of the Internal Revenue Code of 1986, or the Code, existing and proposed U.S. Treasury Regulations promulgated or proposed thereunder and current administrative and judicial interpretations thereof, all as in effect as of the date of this prospectus and all of which are subject to change or to differing interpretation, possibly with retroactive effect. We have not sought and will not seek any rulings from the Internal Revenue Service, or the IRS, regarding the matters discussed below. There can be no assurance that the IRS or a court will not take a contrary position.

This discussion is limited to U.S. holders and non-U.S. holders who hold our securities as capital assets within the meaning of Section 1221 of the Code (generally, as property held for investment). This discussion does not address all aspects of U.S. federal income taxation, such as the U.S. alternative minimum income tax and the Medicare contribution tax on net investment income, nor does it address any aspect of state, local or non-U.S. taxes, or U.S. federal taxes other than income taxes, such as federal estate taxes. This discussion does not consider any specific facts or circumstances that may apply to a holder and does not address the special tax considerations that may be applicable to particular holders, such as:

- banks, insurance companies or other financial institutions;
- tax-exempt or government organizations;
- brokers or dealers in securities or currencies;
- traders in securities that elect to use a mark-to-market method of accounting for their securities holdings;
- regulated investment companies or real estate investment trusts;
- persons that have a “functional currency” other than the U.S. dollar;
- persons that own, or are deemed to own, more than five percent of our capital stock (except to the limited extent set forth herein);
- certain U.S. expatriates or former long-term residents of the United States;
- persons who hold our common stock or warrants as a position in a hedging transaction, “straddle,” “conversion transaction,” synthetic security, other integrated investment, or other risk reduction transaction;
- persons deemed to sell our common stock and warrants under the constructive sale provisions of the Code;
- pension plans or other retirement accounts;
- partnerships, or other entities or arrangements treated as partnerships for U.S. federal income tax purposes, or investors in any such entities;
- integral parts or controlled entities of foreign sovereigns;
- controlled foreign corporations, passive foreign investment companies and corporations that accumulate earnings to avoid U.S. federal income tax; and
- persons required to accelerate the recognition of any item of gross income with respect to securities as a result of such income being recognized on an applicable financial statement.

If any entity taxable as a partnership for U.S. federal income tax purposes holds our securities, the U.S. federal income tax treatment of a partner in the partnership generally will depend on the status of the partner, the activities of the partnership and certain determinations made at the partner level. A partner in a partnership or other pass-through entity that holds our securities should consult his, her or its own tax advisor regarding the applicable tax consequences.

For purposes of this discussion, the term “U.S. holder” means a beneficial owner of our securities that is, for U.S. federal income tax purposes:

- an individual who is a citizen or resident of the United States;

- a corporation (including any entity classified as a corporation for U.S. federal income tax purposes) created or organized in or under the laws of the United States or of 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 (1) a U.S. court is able to exercise primary supervision over the administration of the trust and one or more U.S. persons have authority to control all substantial decisions of the trust or (2) the trust has a valid election to be treated as a U.S. person under applicable U.S. Treasury Regulations.

A “non-U.S. holder” is a beneficial owner of our securities that is not a U.S. holder or an entity taxable as a partnership for U.S. federal income tax purposes.

Prospective investors should consult their own tax advisors regarding the U.S. federal, state, local and non-U.S. income and other tax considerations of purchasing, holding and disposing of our securities.

#### **Tax Treatment of Units**

There is no authority directly addressing the treatment, for U.S. federal income tax purposes, of securities with terms substantially the same as the units, and, therefore, such treatment is not entirely clear. We intend to treat each unit for U.S. federal income tax purposes as consisting of (1) one share of our common stock and (2) one warrant exercisable to acquire one share of our common stock. Pursuant to this treatment, each holder of a unit must allocate the purchase price paid by such holder for such unit between the underlying common stock and warrant based on their respective fair market values. In addition, pursuant to this treatment, a holder’s initial tax basis for U.S. federal income tax purposes in the share of common stock and the warrant that compose each unit should equal the portion of the purchase price of the unit allocated thereto.

The foregoing treatment of the units and a holder’s purchase price allocation are not binding on the IRS or the courts. Because there are no authorities that directly address instruments that are similar to the securities, no assurance can be given that the IRS or the courts will agree with the characterization described above or the discussion below. Accordingly, each prospective investor should consult its own tax advisors regarding the U.S. federal tax consequences of an investment in a unit (including alternative characterizations of a unit) and with respect to any tax consequences arising under the laws of any state, local or non-United States taxing jurisdiction.

Unless otherwise stated, the following discussions are based on the assumption that the characterization of the common stock and warrants described above is accepted for U.S. federal income tax purposes.

#### **U.S. Holders**

##### *Exercise of Warrants*

Except as discussed below with respect to a cashless exercise of a warrant, a U.S. holder generally will not recognize gain or loss on the exercise of a warrant and related receipt of shares of our common stock. A U.S. holder’s initial tax basis in the shares of our common stock received upon exercise of a warrant will be equal to the sum of (a) such U.S. holder’s tax basis in such warrant (i.e., the portion of the U.S. holder’s purchase price for a unit that is allocated to the warrant, as described above) plus (b) the exercise price paid by such U.S. holder on the exercise of such warrant. A U.S. holder’s holding period for the shares of our common stock underlying the warrants will begin on the day after the date that the warrant is exercised and will not include the period during which the U.S. holder held the warrant.

In certain circumstances, the warrants will be exercisable on a cashless basis. The U.S. federal income tax treatment of an exercise of a warrant on a cashless basis is not clear, and could differ from the consequences described above. It is possible that a cashless exercise could be a taxable event. U.S. holders should consult their own tax advisors regarding the U.S. federal income tax consequences of the cashless exercise of warrants, including with respect to whether the exercise is a taxable event, and their holding period and tax basis in the common stock received.

*Certain Adjustments to the Warrants*

The terms of each warrant provide for an adjustment to the number of shares of common stock for which the warrant may be exercised or to the exercise price of the warrant in certain events, and a distribution upon exercise that corresponds to distributions, if any, made on the common stock after issuance of the warrants and prior to exercise. An adjustment to the exercise price of a warrant may be treated as a constructive distribution to a U.S. holder of the warrants or shares of our common stock depending on the circumstances of such adjustment if, and to the extent that, such adjustment has the effect of increasing such U.S. holder's proportionate interest in our "earnings and profits" or assets, depending on the circumstances of such adjustment. In addition, the failure to provide for such an adjustment (or to adequately adjust) may also result in a deemed distribution to U.S. holders of the warrants or shares of our common stock. Any such constructive distribution may be taxable whether or not there is an actual distribution of cash or other property. However, adjustments to the exercise price of warrants made pursuant to a bona fide reasonable adjustment formula that has the effect of preventing dilution of the interest of the holders thereof generally should not be considered to result in a constructive distribution. Generally, such deemed distributions will be taxable in the same manner as an actual distribution as described below under "—Distributions on Common Stock," below, except that it is unclear whether such deemed distributions would be eligible for the reduced tax rate applicable to certain dividends paid to non-corporate holders or the dividend-received deduction applicable to certain dividends paid to corporate holders. Generally, a U.S. holder's tax basis in the underlying stock will be increased to the extent any such constructive distribution is treated as a dividend. Proposed U.S. Treasury Regulations address the amount of, timing of, and withholding obligations in respect to, constructive distributions made to holders of convertible securities such as the warrants. These proposed regulations are effective for constructive distributions made on or after the date of finalization, but may generally be relied upon as to certain matters for constructive distributions that occur prior to such date. You should consult your tax advisor regarding the application of such regulations and other tax considerations relating to the possibility of constructive distributions.

*Expiration of the Warrants without Exercise*

Upon the lapse or expiration of a warrant, a U.S. holder will recognize a loss in an amount equal to such U.S. holder's tax basis in the warrant. Any such loss generally will be a capital loss and will be long-term capital loss if the warrant is held for more than one year. Deductions for capital losses are subject to limitations.

*Distributions on Common Stock*

If we pay distributions of cash or property with respect to shares of our common stock (including constructive distributions as described above under the heading "Certain Adjustments to the Warrants"), those distributions generally will constitute dividends for U.S. federal income tax purposes to the extent paid from our current or accumulated earnings and profits, as determined under U.S. federal income tax principles. If a distribution exceeds our current and accumulated earnings and profits, the excess will be treated as a tax-free return of the U.S. holder's investment, up to such holder's tax basis in its shares of our common stock. Any remaining excess will be treated as capital gain, subject to the tax treatment described below under the heading "—Gain on Sale, Exchange or Other Taxable Disposition of Common Stock or Warrants." Dividends received by a corporate U.S. holder may be eligible for the dividends received deduction, and dividends received by non-corporate U.S. holders generally will be subject to tax at the current lower applicable capital gains rates, provided, in each case, that certain holding period and other applicable requirements are satisfied.

*Gain on Sale, Exchange or Other Taxable Disposition of Common Stock or Warrants*

Upon the sale or other taxable disposition of shares of our common stock or warrants, a U.S. holder generally will recognize capital gain or loss in an amount equal to the difference, if any between (a) the amount of cash plus the fair market value of any property received and (b) such U.S. holder's tax basis in such shares of our common stock or warrants sold or otherwise disposed of. Such gain or loss generally will be long-term capital

gain or loss if, at the time of the sale or other disposition, the shares of our common stock or warrants have been held by the U.S. holder for more than one year. Preferential tax rates may apply to long-term capital gain of a U.S. holder that is an individual, estate or trust. Deductions for capital losses are subject to significant limitations.

#### **Non-U.S. Holders**

##### *Exercise or Expiration of Warrants*

In general, a non-U.S. holder will not be required to recognize income, gain or loss upon the exercise of a warrant by payment of the exercise price in cash. A non-U.S. holder's initial tax basis in the shares of our common stock received upon exercise of a warrant will be equal to the sum of (a) such non-U.S. holder's tax basis in such warrant (i.e., the portion of the non-U.S. holder's purchase price for a unit that is allocated to the warrant, as described above) plus (b) the exercise price paid by such non-U.S. holder on the exercise of such warrant. A non-U.S. holder's holding period for the shares of our common stock underlying the warrants will begin on the day after the date that the warrant is exercised and will not include the period during which the non-U.S. holder held the warrant.

As discussed above in "—U.S. Holders—Exercise of Warrants," the U.S. federal income tax treatment of an exercise of a warrant on a cashless basis is not clear. Non-U.S. holders are urged to consult their tax advisors as to the consequences of an exercise of a warrant on a cashless basis, including with respect to whether the exercise is a taxable event, and their holding period and tax basis in the common stock received.

If a warrant expires without being exercised, a non-U.S. holder that is engaged in a U.S. trade or business to which any income from the warrant would be effectively connected or who is present in the United States for a period or periods aggregating 183 days or more during the calendar year in which the expiration occurs (and certain other conditions are met) will recognize a capital loss in an amount equal to such non-U.S. holder's tax basis in the warrant.

##### *Distributions*

If we pay distributions of cash or property with respect to shares of our common stock (including constructive distributions as described above under the heading "—Certain Adjustments to the Warrants"), those distributions generally will constitute dividends for U.S. federal income tax purposes to the extent paid from our current or accumulated earnings and profits, as determined under U.S. federal income tax principles. If a distribution exceeds our current and accumulated earnings and profits, the excess will be treated as a tax-free return of the non-U.S. holder's investment, up to such holder's tax basis in its shares of our common stock. Any remaining excess will be treated as capital gain, subject to the tax treatment described below under the heading "—Gain on Sale, Exchange or Other Taxable Disposition of Common Stock or Warrants." Dividends paid to a non-U.S. holder generally will be subject to withholding of U.S. federal income tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty between the United States and such holder's country of residence. In the case of any constructive distribution, it is possible that this tax would be withheld from any amount owed to the non-U.S. holder, including, but not limited to, distributions of cash, shares of our common stock or sales proceeds subsequently paid or credited to that holder. If we are unable to determine, at the time of payment of a distribution, whether the distribution will constitute a dividend, we may nonetheless choose to withhold any U.S. federal income tax on the distribution as permitted by U.S. Treasury Regulations.

Distributions that are treated as effectively connected with a trade or business conducted by a non-U.S. holder within the United States (and if an income tax treaty applies and so requires, such distribution is attributable to a permanent establishment or fixed base maintained by such non-U.S. holder in the United States) are generally not subject to the 30% withholding tax if the non-U.S. holder provides a properly executed IRS Form W-8ECI (which should be renewed periodically) stating that the distributions are not subject to withholding because they are effectively connected with the non-U.S. holder's conduct of a trade or business in the United States. If a non-



U.S. holder is engaged in a trade or business in the United States and the distribution is effectively connected with the conduct of that trade or business, the distribution will not be subject to withholding and will generally have the consequences described above for a U.S. holder (subject to any modification provided under an applicable income tax treaty). Any U.S. effectively connected income received by a non-U.S. holder that is treated as a corporation for U.S. federal income tax purposes may also, under certain circumstances, be subject to an additional “branch profits tax” at a 30% rate (or such lower rate as may be specified by an applicable income tax treaty).

A non-U.S. holder who claims the benefit of an applicable income tax treaty between the United States and such holder’s country of residence generally will be required to provide a properly executed IRS Form W-8BEN or W-8BEN-E, as applicable (which should be renewed periodically), and satisfy applicable certification and other requirements. A non-U.S. holder that is eligible for a reduced rate of U.S. withholding tax under an income tax treaty generally may obtain a refund or credit of any excess amounts withheld by timely filing an appropriate claim with the IRS. Non-U.S. holders should consult their own tax advisors regarding their entitlement to benefits under a relevant income tax treaty.

Distributions on shares of our common stock paid to a non-U.S. holder may also be subject to the withholding described under “—The Foreign Account Tax Compliance Act” below.

*Gain on Sale, Exchange or Other Taxable Disposition of common stock or warrants*

Subject to the discussion below in “—Information Reporting and Backup Withholding” and “—Foreign Account Tax Compliance Act,” a non-U.S. holder generally will not be subject to U.S. federal income tax on gain recognized on a sale, exchange or other taxable disposition of shares of our common stock or warrants unless:

- the gain is effectively connected with the non-U.S. holder’s conduct of a trade or business in the United States and, if an applicable income tax treaty so provides, the gain is attributable to a permanent establishment or fixed base maintained by the non-U.S. holder in the United States; in these cases, the non-U.S. holder will be taxed on a net income basis at the regular graduated rates and in the manner applicable to a U.S. holder, and, if the non-U.S. holder is a corporation, an additional branch profits tax at a rate of 30%, or a lower rate as may be specified by an applicable income tax treaty, may also apply;
- the non-U.S. holder is an individual present in the United States for 183 days or more in the taxable year of the disposition and certain other conditions are met, in which case the non-U.S. holder will be subject to a 30% tax (or such lower rate as may be specified by an applicable income tax treaty) on the amount by which such non-U.S. holder’s capital gains allocable to U.S. sources exceed capital losses allocable to U.S. sources during the taxable year of the disposition; or
- we are or were a “U.S. real property holding corporation” during the shorter of the five-year period ending on the date of the disposition or the period that the non-U.S. holder held shares of our common stock. Generally, a corporation is a “U.S. real property holding corporation” if the fair market value of its “U.S. real property interests” (within the meaning of the Code) equals or exceeds 50% of the sum of the fair market value of its worldwide real property interests plus its other assets used or held for use in a trade or business. We believe that we are not currently, and we do not anticipate becoming, a “U.S. real property holding corporation” for U.S. federal income tax purposes. Even if we are treated as a U.S. real property holding corporation, gain realized by a non-U.S. holder on a disposition of shares 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 five percent 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) shares of our common stock are regularly traded on an established securities market as set forth in the applicable U.S. Treasury Regulations. There can be no assurance that shares of our common stock will qualify as regularly traded on an established securities market at the time of disposition. Disposition by a non-U.S. holder of our warrants (that are not expected to be regularly traded on an established securities market) may also be eligible for an

exemption from withholding even if we are treated as a U.S. real property holding corporation, if on the date such warrants were acquired by such non-U.S. holder such holdings had a fair market value no greater than the fair market value on that date of five percent of our regularly-traded common stock, provided that, if a non-U.S. holder holding our not regularly-traded warrants subsequently acquires additional such securities, then such interests would be aggregated and valued as of the date of the subsequent acquisition in order to apply this five percent limitation. Non-U.S. holders should consult their own tax advisors.

#### *Dividend Equivalents*

Section 871(m) of the Code requires withholding (up to 30%, depending on whether a treaty applies) on certain financial instruments to the extent that the payments or deemed payments on the financial instruments are contingent upon or determined by reference to U.S.-source dividends. Under U.S. Treasury Regulations promulgated under Section 871(m), certain payments or deemed payments to non-U.S. holders with respect to certain equity-linked instruments, or specified ELIs, that reference U.S. stocks may be treated as dividend equivalents (“dividend equivalents”) that are subject to U.S. withholding tax at a rate of 30% (or lower treaty rate). Under these U.S. Treasury Regulations, withholding may be required even in the absence of any actual dividend related payment or adjustment made pursuant to the terms of the instrument. Under U.S. Treasury Regulations promulgated under Section 871(m) and other IRS guidance, Section 871(m) will apply to financial instruments issued in 2018 only if they are “delta-one.” A “delta-one” instrument is one in which the ratio of the change in the fair market value of the instrument to a small change in the fair market value of the property referenced by the instrument is equal to 1.00. We do not believe that the warrants are delta-one instruments. Accordingly, non-U.S. holders of the warrants should not be subject to tax under Section 871(m). However, if withholding is required, we (or the applicable paying agent) would be entitled to withhold such taxes without being required to pay any additional amounts with respect to amounts so withheld. Non-U.S. Holders should consult with their tax advisors regarding the application of Section 871(m) and the regulations thereunder in respect of their acquisition and ownership of the warrants.

#### *Foreign Account Tax Compliance Act*

Legislation commonly known as the Foreign Account Tax Compliance Act, or FATCA, and guidance issued thereunder may impose withholding taxes on certain types of payments made to “foreign financial institutions” (as specifically defined) and certain other non-U.S. entities (including financial intermediaries). Under FATCA, failure to comply with certification, information reporting and other specified requirements could result in withholding tax being imposed on payments of dividends and sales proceeds of any property of a type which can produce U.S. source dividends to foreign intermediaries and certain non-U.S. holders. FATCA imposes a 30% withholding tax on dividends or gross proceeds from the sale or other disposition of the shares of our common stock paid to a foreign financial institution or to a non-financial foreign entity, unless (i) the foreign financial institution undertakes certain diligence and reporting obligations, (ii) the non-financial foreign entity either certifies it does not have any “substantial United States owners” as specifically defined in FATCA or furnishes identifying information regarding each substantial United States owner or (iii) the foreign financial institution or the non-financial foreign entity qualifies for an exemption from the withholding tax. We intend to treat the warrants as also subject to FATCA. If the payee is a foreign financial institution, in the absence of any applicable exemption, it must enter into an agreement with the United States Treasury requiring, among other things, that it undertake to identify accounts held by certain United States persons or United States-owned foreign entities, annually report certain information about such accounts, and withhold 30% on “withholdable payments” (as specifically defined) made to certain account holders. An intergovernmental agreement between the United States and the foreign entity’s jurisdiction may modify these requirements. Under certain transition rules, any obligation to withhold under FATCA with respect to payments of dividends on the common stock and warrants is currently in effect, but with respect to the gross proceeds of a sale or other disposition of the warrants or the common stock the obligation to withhold under FATCA will not begin until January 1, 2019. Prospective investors should consult their tax advisors regarding the implications of FATCA with respect to an investment in the units.

**Information Reporting and Backup Withholding Applicable to U.S. Holders and Non-U.S. Holders**

Distributions on, and the payment of the proceeds of a disposition of, shares of our common stock or warrants generally will be subject to information reporting if made within the United States or through certain U.S.-related financial intermediaries. Information returns are required to be filed with the IRS and copies of information returns may be made available to the tax authorities of the country in which a holder resides or is incorporated under the provisions of a specific treaty or agreement.

Backup withholding may also apply if the holder fails to provide certification of exempt status or a correct U.S. taxpayer identification number and otherwise comply with the applicable backup withholding requirements. Generally, a holder will not be subject to backup withholding if it provides a properly completed and executed IRS Form W-9 or appropriate IRS Form W-8, as applicable. Backup withholding is not an additional tax. Amounts withheld under the backup withholding rules may be refunded or credited against the holder's U.S. federal income tax liability, if any, provided certain information is timely filed with the IRS.

**The preceding discussion of U.S. federal tax considerations is for general information only. It is not tax advice. Each prospective investor should consult its tax advisor regarding the particular U.S. federal, state and local and non-U.S. tax consequences of purchasing, holding and disposing of our common stock or common warrants, including the consequences of any recent or proposed change in applicable laws.**

## UNDERWRITING

We have entered into an underwriting agreement with Roth Capital Partners, LLC, acting as the representative of the underwriters named below, with respect to the units subject to this offering. Subject to certain conditions, we have agreed to sell to the underwriters, and the underwriters have agreed to purchase, the number of units provided below opposite their respective names.

<u>Underwriter</u>	<u>Number of Units</u>
Roth Capital Partners, LLC	2,268,000
Maxim Group LLC	756,000
LifeSci Capital LLC	336,000
Total	<u>3,360,000</u>

The underwriters are offering the units, subject to their acceptance of the units 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 securities 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 securities if any such securities are taken. However, the underwriters are not required to take or pay for the securities covered by the underwriters' over-allotment option described below.

### Over-Allotment Option

We have granted the underwriters an option, exercisable for 30 days from the date of this prospectus, to purchase up to 504,000 units to cover over-allotments, if any, at the public offering price set forth 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 securities offered by this prospectus. If the underwriters exercise this option, each underwriter will be obligated, subject to certain conditions, to purchase a number of additional units proportionate to that underwriter's initial purchase commitment as indicated in the table above.

### Commission and Expenses

The underwriters have advised us that they propose to offer the units to the public at the initial public offering price set forth on the cover page of this prospectus and to certain dealers at that price less a concession not in excess of \$0.21 per unit. After this offering, the initial public offering price, concession and allowance to dealers may be reduced by the representatives. No such reduction shall change the amount of proceeds to be received by us as set forth on the cover page of this prospectus. The units are offered by the underwriters as stated herein, subject to receipt and acceptance by them and subject to their right to reject any order in whole or in part. The underwriters have informed us that they do not intend to confirm sales to any accounts over which they exercise discretionary authority.

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The following table shows the underwriting discounts and commissions payable to the underwriters by us in connection with this offering. Such amounts are shown assuming both no exercise and full exercise of the underwriters' over-allotment option to purchase securities.

	Without Exercise of Over- Allotment <sup>(1)</sup>	With Full Exercise of Over- Allotment <sup>(1)</sup>
Public offering price per unit	\$ 0.4288	\$ 0.4288
Total	\$ 1,440,600	\$ 1,656,690

(1) The fees do not include the Underwriter's Warrants or expense reimbursement provisions described below.

We have also agreed to issue to the underwriters warrants to purchase shares of common stock collectively equal to an aggregate of 3% of the shares of common stock underlying the units issued in the offering. The underwriter warrants will have an exercise price per share equal to 150% of the offering price per unit sold in this offering and may be exercised on a cashless basis. The underwriter warrants are exercisable commencing one year after the effective date of the registration statement related to this offering, and will be exercisable for four years thereafter. The underwriter warrants are not redeemable by us. The warrants and the shares of common stock underlying the warrants, have been deemed compensation by FINRA and are therefore subject to a 180-day lock-up pursuant to Rule 5110(g)(1) of FINRA. The underwriters (or permitted assignees under the Rule) may not sell, transfer, assign, pledge, or hypothecate the underwriter warrants or the shares of common stock underlying the underwriter warrants, nor will they engage in any hedging, short sale, derivative, put, or call transaction that would result in the effective economic disposition of the underwriter warrants or the underlying shares of common stock for a period of 180 days from the date of this prospectus. Additionally, the underwriter warrants may not be sold transferred, assigned, pledged or hypothecated for a 180 day period following the effective date of the registration statement except to any underwriter and selected dealer participating in the offering and their bona fide officers or partners. The underwriter warrants will provide for adjustment in the number and price of such underwriter warrants and the shares of common stock underlying such warrants in the event of recapitalization, merger or other structural transaction to prevent mechanical dilution.

We have also agreed to reimburse the underwriters for certain out-of-pocket expenses incurred by them, including fees and disbursements of their counsel up to an aggregate of \$150,000, with respect to this offering.

We estimate that expenses payable by us in connection with the offering of our units, other than the underwriting discounts and commissions and the counsel fees and disbursement reimbursement provisions referred to above, will be approximately \$1.8 million.

### **Indemnification**

We have agreed to indemnify the underwriters against certain liabilities, including liabilities under the Securities Act and liabilities arising from breaches of representations and warranties contained in the underwriting agreement, or to contribute to payments that the underwriters may be required to make in respect of those liabilities.

### **Lock-Up Agreements**

Our executive officers, directors and certain of our stockholders, which represent substantially all of our currently outstanding shares of common stock, have agreed to a 180-day (except for our chief executive officer, who has agreed to 18 months) "lock-up" from the effective date of this prospectus of shares of our common stock that they beneficially own, including the issuance of common stock upon the exercise of currently outstanding convertible securities and options and options which may be issued. This means that, for a period of 180 days

following the effective date of this prospectus, such persons may not offer, sell, pledge or otherwise dispose of these securities without the prior written consent of the representative of the underwriters. The lock-up period described in the preceding paragraph will be extended if the Company ceases to be an “emerging growth company” at any time prior to the expiration of the lock-up period and if (1) during the last 17 days of the lock-up period we issue an earnings release or material news or a material event relating to us occurs or (2) prior to the expiration of the lock-up period we announce that we will release earnings results during the 16-day period beginning on the last day of the lock-up period, in which case the lock-up period will be extended until the expiration of the 18-day period beginning on the date of issuance of the earnings release or the occurrence of the material news or material event.

The representative of the underwriters has no present intention to waive or shorten the lock-up period; however, the terms of the lock-up agreements may be waived at its discretion. In determining whether to waive the terms of the lockup agreements, the representative of the underwriters may base its decision on its assessment of the relative strengths of the securities markets and companies similar to ours in general, and the trading pattern of, and demand for, our securities in general.

In addition, the underwriting agreement provides that, subject to certain exceptions, we will not, for a period of 180 days following the effective date of this prospectus, offer, sell or distribute any of our securities or file any registration statement with the commission relating to the offering of any shares of Common Stock or any securities convertible into or exchangeable for Common Stock, without the prior written consent of the representative of the underwriters.

### **Listing**

Our units, common stock and warrants have been approved for listing on the Nasdaq Stock Market LLC under the symbols “BNGOU,” “BNGO” and “BNGOW,” respectively.

### **Electronic Distribution**

A prospectus in electronic format may be made available on websites or through other online services maintained by one or more of the underwriters of this offering, or by their affiliates. Other than the prospectus in electronic format, the information on any underwriter’s website and any information contained in any other website maintained by an underwriter is not part of this prospectus or the registration statement of which this prospectus forms a part, has not been approved and/or endorsed by us or any underwriter in its capacity as underwriter, and should not be relied upon by investors.

### **Price Stabilization, Short Positions and Penalty Bids**

In connection with the offering the underwriters may engage in stabilizing transactions, over-allotment transactions, syndicate covering transactions and penalty bids in accordance with Regulation M under the Exchange Act:

- Stabilizing transactions permit bids to purchase the underlying security so long as the stabilizing bids do not exceed a specified maximum.
- Over-allotment involves sales by the underwriters of shares in excess of the number of shares the underwriters are obligated to purchase, which creates a syndicate short position. The short position may be either a covered short position or a naked short position. In a covered short position, the number of shares over-allotted by the underwriter is not greater than the number of shares that it may purchase in the over-allotment option. In a naked short position, the number of shares involved is greater than the number of shares in the over-allotment option. The underwriter may close out any covered short position by either exercising its over-allotment option and/or purchasing shares in the open market.

- Syndicate covering transactions involve purchases of shares of the common stock in the open market after the distribution has been completed in order to cover syndicate short positions. In determining the source of shares to close out the short position, the underwriters will consider, among other things, the price of shares available for purchase in the open market as compared to the price at which it may purchase shares through the over-allotment option. If the underwriters sell more shares than could be covered by the over-allotment option, a naked short position, the position can only be closed out by buying shares in the open market. A naked short position is more likely to be created if the underwriters are concerned that there could be downward pressure on the price of the shares in the open market after pricing that could adversely affect investors who purchase in the offering.
- Penalty bids permit the representative to reclaim a selling concession from a syndicate member when the common stock originally sold by the syndicate member is purchased in a stabilizing or syndicate covering transaction to cover syndicate short positions.

These stabilizing transactions, syndicate covering transactions and penalty bids may have the effect of raising or maintaining the market price of our securities or preventing or retarding a decline in the market price of our securities. As a result, the price of our securities may be higher than the price that might otherwise exist in the open market. Neither we nor the underwriters makes any representation or prediction as to the direction or magnitude of any effect that the transactions described above may have on the price of our securities. In addition, neither we nor the underwriters makes any representations that the underwriters will engage in these stabilizing transactions or that any transaction, once commenced, will not be discontinued without notice.

#### **No Public Market**

Prior to this offering, there has not been a public market for our securities in the U.S. and the public offering price for our securities will be determined through negotiations between us and the underwriters. Among the factors to be considered in these negotiations will be prevailing market conditions, our financial information, market valuations of other companies that we and the underwriters believe to be comparable to us, estimates of our business potential, the present state of our development and other factors deemed relevant.

We offer no assurances that the initial public offering price will correspond to the price at which our securities will trade in the public market subsequent to this offering or that an active trading market for our securities will develop and continue after this offering.

#### **Notice to Prospective Investors in the European Economic Area**

In relation to each Member State of the European Economic Area (“EEA”) which has implemented the Prospectus Directive (each, a “Relevant Member State”) an offer to the public of any shares which are the subject of the offering contemplated by this prospectus may not be made in that Relevant Member State, except that an offer to the public in that Relevant Member State of any shares 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 legal entities which are authorized or regulated to operate in the financial markets or, if not so authorized or regulated, whose corporate purpose is solely to invest in securities;
- (b) to any legal entity which has two or more of (1) an average of at least 250 employees during the last financial year; (2) a total balance sheet of more than €43,000,000 and (3) an annual net turnover of more than €50,000,000, as shown in its last annual or consolidated accounts;
- (c) by the underwriters 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) subject to obtaining the prior consent of the representatives for any such offer; or
- (d) in any other circumstances falling within Article 3(2) of the Prospectus Directive;

provided that no such offer of shares shall result in a requirement for the publication by us or any representative of a prospectus pursuant to Article 3 of the Prospectus Directive.

Any person making or intending to make any offer of shares within the EEA should only do so in circumstances in which no obligation arises for us or any of the underwriters to produce a prospectus for such offer. Neither we nor the underwriters have authorized, nor do they authorize, the making of any offer of shares through any financial intermediary, other than offers made by the underwriters which constitute the final offering of shares contemplated in this prospectus.

For the purposes of this provision, and your representation below, the expression an “offer to the public” in relation to any shares 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 to be offered so as to enable an investor to decide to purchase any shares, as the same may be varied in that Relevant Member State by any measure implementing the Prospectus Directive in that Relevant Member State and the expression “Prospectus Directive” means Directive 2003/71/EC and includes any relevant implementing measure in each Relevant Member State, including the 2010 PD Amending Directive, to the extent implemented in the Relevant Member State. The expression “2010 PD Amending Directive” means Directive 2010/73/EU.

Each person in a Relevant Member State who receives any communication in respect of, or who acquires any shares under, the offer of shares contemplated by this prospectus will be deemed to have represented, warranted and agreed to and with us and each underwriter that:

(A) it is a “qualified investor” within the meaning of the law in that Relevant Member State implementing Article 2(1)(e) of the Prospectus Directive; and

(B) in the case of any shares acquired by it as a financial intermediary, as that term is used in Article 3(2) of the Prospectus Directive, (i) the shares acquired by it in the offering have not been acquired on behalf of, nor have they been acquired with a view to their offer or resale to, persons in any Relevant Member State other than “qualified investors”, as defined in the Prospectus Directive, or in circumstances in which the prior consent of the representatives has been given to the offer or resale; or (ii) where shares have been acquired by it on behalf of persons in any Relevant Member State other than qualified investors, the offer of those shares to it is not treated under the Prospectus Directive as having been made to such persons.

In addition, in the United Kingdom, this document is being distributed only to, and is directed only at, and any offer subsequently made may only be directed at persons who are “qualified investors”, as defined in the Prospectus Directive, (i) who have professional experience in matters relating to investments falling within Article 19 (5) of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005, as amended, or the order, and/or (ii) who are high net worth companies (or persons to whom it may otherwise be lawfully communicated) falling within Article 49(2)(a) to (d) of the Order (all such persons together being referred to as “relevant persons”). This document must not be acted on or relied on in the United Kingdom by persons who are not relevant persons. In the United Kingdom, any investment or investment activity to which this document relates is only available to, and will be engaged in with, relevant persons.

#### *Other Relationships*

Some of the underwriters and their affiliates have engaged in, and may in the future engage in, investment banking and other commercial dealings in the ordinary course of business with us or our affiliates. They have received, or may in the future receive, customary fees and commissions for these transactions.



## LEGAL MATTERS

Cooley LLP, San Diego, California, which has acted as our counsel in connection with this offering, will pass on certain legal matters with respect to U.S. federal law in connection with this offering. Loeb & Loeb LLP, New York, New York, has acted as counsel to the underwriters in connection with this offering.

## EXPERTS

The consolidated financial statements included in this Prospectus have been audited by Deloitte & Touche LLP, an independent registered public accounting firm, as stated in their report appearing herein (which report expresses an unqualified opinion on the consolidated financial statements and includes an explanatory paragraph referring to the Company's ability to continue as a going concern). 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.

## WHERE YOU CAN FIND ADDITIONAL INFORMATION

We have filed with the SEC a registration statement on Form S-1 under the Securities Act with respect to the securities offered by this prospectus. This prospectus, which constitutes a part of the registration statement, does not contain all the information set forth in the registration statement, some of which is contained in exhibits to the registration statement as permitted by the rules and regulations of the SEC. For further information with respect to us and our securities, we refer you to the registration statement, including the exhibits filed as a part of the registration statement. Statements contained in this prospectus concerning the contents of any contract or any other document are not necessarily complete. If a contract or document has been filed as an exhibit to the registration statement, please see the copy of the contract or document that has been filed. Each statement in this prospectus relating to a contract or document filed as an exhibit is qualified in all respects by the filed exhibit. You may obtain copies of this information by mail from the Public Reference Section of the SEC, 100 F Street, N.E., Room 1580, Washington, D.C. 20549, at prescribed rates. You may obtain information on the operation of the public reference rooms by calling the SEC at 1-800-SEC-0330. The SEC also maintains an internet website that contains reports and other information about issuers, like us, that file electronically with the SEC. The address of that website is [www.sec.gov](http://www.sec.gov).

On the closing of this offering, we will be subject to the information reporting requirements of the Exchange Act, 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 and copying at the public reference room and website of the SEC referred to above.

We also maintain a website at [www.amplyx.com](http://www.amplyx.com). Information contained in, or accessible through, our website is not a part of this prospectus, and the inclusion of our website address in this prospectus is only as an inactive textual reference.

**Bionano Genomics, Inc.**

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**REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM**

To the stockholders and Board of Directors of Bionano Genomics, Inc.

**Opinion on the Financial Statements**

We have audited the accompanying consolidated balance sheets of Bionano Genomics, Inc. and its subsidiaries (the “Company”), as of December 31, 2016 and 2017 and the related consolidated statements of operations, consolidated statements of convertible preferred stock and stockholders’ deficit, and consolidated statements of cash flows for each of the two years in the period ended December 31, 2017 and the related notes (collectively referred to as the “financial statements”). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2016 and 2017, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2017, in conformity with accounting principles generally accepted in the United States of America.

**Going Concern**

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

**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) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. 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 Diego, California

May 11, 2018 (July 16, 2018 as to the effects of the reverse stock split and August 15, 2018 as to the effects of the second reverse stock split, both described in Note 12)

We have served as the Company’s auditor since 2017.

**Bionano Genomics, Inc.**  
**Consolidated Balance Sheets**

	<u>December 31,</u>		<u>June 30,</u>	<u>Pro Forma</u>
	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>Liabilities,</u>
			<u>(unaudited)</u>	<u>Convertible</u>
				<u>Preferred</u>
				<u>Stock, and</u>
				<u>Stockholders'</u>
				<u>(Deficit)</u>
				<u>Equity</u>
				<u>June 30,</u>
				<u>2018</u>
				<u>(unaudited)</u>
<b>Assets</b>				
Current assets:				
Cash and cash equivalents	\$ 5,249,620	\$ 1,021,897	\$ 7,624,289	
Accounts receivable, net	1,846,567	3,352,214	2,886,205	
Inventory	1,797,401	1,693,742	1,972,938	
Prepaid expenses and other current assets	1,842,066	1,071,512	3,170,223	
<b>Total current assets</b>	<b>10,735,654</b>	<b>7,139,365</b>	<b>15,653,655</b>	
Property and equipment, net	4,052,083	3,005,788	2,440,501	
<b>Total assets</b>	<b>\$14,787,737</b>	<b>\$10,145,153</b>	<b>\$18,094,156</b>	
<b>Liabilities, convertible preferred stock, and stockholders' deficit</b>				
Current liabilities:				
Accounts payable	\$ 792,332	\$ 2,302,964	\$ 1,752,325	\$ 1,752,325
Accrued expenses	2,886,726	3,508,894	4,498,872	4,498,872
Deferred revenue	446,769	211,697	241,196	241,196
Preferred stock warrant liability	4,650,877	3,898,944	1,604,836	—
Current portion of long-term debt	587,131	6,729,752	—	—
Convertible note	—	—	14,329,843	—
<b>Total current liabilities</b>	<b>9,363,835</b>	<b>16,652,251</b>	<b>22,427,072</b>	<b>6,492,393</b>
Long-term debt, net of current portion	6,046,045	—	8,956,143	8,956,143
Long-term deferred revenue	244,884	142,929	144,601	144,601
Other non-current liabilities	975,418	567,047	833,814	833,814
<b>Total liabilities</b>	<b>16,630,182</b>	<b>17,362,227</b>	<b>32,361,630</b>	<b>16,426,951</b>
Commitments and contingencies (Note 9)				
Series A convertible preferred stock, \$0.0001 par value; 418,767 shares authorized as of December 31, 2016 and 2017 and June 30, 2018 (unaudited); 345,587 shares issued and outstanding as of December 31, 2016 and 2017 and June 30, 2018 (unaudited); \$483,649 liquidation preference at December 31, 2017 and June 30, 2018 (unaudited); no shares authorized, issued or outstanding pro forma at June 30, 2018 (unaudited)	61,847	61,847	61,847	—
Series B convertible preferred stock, \$0.0001 par value; 8,101,042 shares authorized as of December 31, 2016 and 2017 and June 30, 2018 (unaudited); 8,058,170 shares issued and outstanding as of December 31, 2016 and 2017 and June 30, 2018 (unaudited); \$11,277,409 liquidation preference at December 31, 2017 and June 30, 2018 (unaudited); no shares authorized, issued or outstanding pro forma at June 30, 2018 (unaudited)	842,845	842,845	842,845	—
Series B-1 convertible preferred stock, \$0.0001 par value; 7,523,734 shares authorized as of December 31, 2016 and 2017 and June 30, 2018 (unaudited); 3,437,950 shares issued and outstanding as of December 31, 2016 and 2017 and June 30, 2018 (unaudited); \$4,811,411 liquidation preference at December 31, 2017 and June 30, 2018 (unaudited); no shares authorized, issued or outstanding pro forma at June 30, 2018 (unaudited)	359,593	359,593	359,593	—

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	December 31,		June 30, 2018 (unaudited)	Pro Forma Liabilities, Convertible Preferred Stock, and Stockholders' (Deficit) Equity June 30, 2018 (unaudited)
	2016	2017		
Series C convertible preferred stock, \$0.0001 par value; 23,357,047 shares authorized as of December 31, 2016 and 2017 and June 30, 2018 (unaudited); 23,357,047 shares issued and outstanding as of December 31, 2016 and 2017 and June 30, 2018 (unaudited); \$32,800,301 liquidation preference at December 31, 2017 and June 30, 2018 (unaudited); no shares authorized, issued or outstanding pro forma at June 30, 2018 (unaudited)	5,547,841	5,547,841	5,547,841	—
Series D convertible preferred stock, \$0.0001 par value; 52,835,720 shares authorized as of December 31, 2016 and 2017 and June 30, 2018 (unaudited), respectively; 20,652,486 shares issued and outstanding as of December 31, 2016 and 2017 and June 30, 2018 (unaudited), respectively; \$9,913,193 liquidation preference at December 31, 2017 and June 30, 2018 (unaudited), respectively; no shares authorized, issued or outstanding pro at June 30, 2018 (unaudited)	4,838,379	4,838,379	4,838,379	—
Series D-1 convertible preferred stock, \$0.0001 par value; 73,208,367, 125,808,667 and 126,746,167 shares authorized as of December 31, 2016 and 2017 and June 30, 2018 (unaudited), respectively; 29,166,671, 66,141,257 and 66,141,257 shares issued and outstanding as of December 31, 2016 and 2017, and June 30, 2018 (unaudited) respectively; \$31,747,803 liquidation preference at December 31, 2017 and June 30, 2018 (unaudited); no shares authorized, issued or outstanding pro at June 30, 2018 (unaudited)	13,766,022	31,359,632	31,359,632	—
Stockholders' deficit:				
Common stock, \$0.0001 par value; 190,559,820, 243,160,120 and 244,097,620 shares authorized at December 31, 2016 and 2017 and June 30, 2018 (unaudited), respectively; 70,178, 77,257 and 78,045 shares issued and outstanding as of December 31, 2016 and 2017 and June 30, 2018 (unaudited), respectively; 6,131,142 shares issued and outstanding proforma at June 30, 2018	7	8	8	613
Additional paid-in capital	3,641,693	4,038,817	4,147,255	63,091,466
Accumulated deficit	<u>(30,900,672)</u>	<u>(54,266,036)</u>	<u>(61,424,874)</u>	<u>(61,424,874)</u>
Total stockholders' (deficit) equity	<u>(27,258,972)</u>	<u>(50,227,211)</u>	<u>(57,277,611)</u>	<u>1,667,205</u>
Total liabilities, convertible preferred stock, and stockholders' deficit	<u>\$ 14,787,737</u>	<u>\$ 10,145,153</u>	<u>\$ 18,094,156</u>	

See accompanying notes

**Bionano Genomics, Inc.**

**Consolidated Statements of Operations**

	Year Ended December 31,		Six Months Ended June 30,	
	2016	2017	2017	2018
	(unaudited)			
<b>Revenue:</b>				
Product revenue	\$ 6,153,355	\$ 8,769,704	\$ 3,609,281	\$ 4,918,245
Other revenue	639,434	735,339	307,583	240,249
Total revenue	6,792,789	9,505,043	3,916,864	5,158,494
<b>Operating expenses:</b>				
Cost of product revenue	3,459,771	5,958,537	2,818,861	2,644,043
Cost of other revenue	118,921	71,975	25,256	10,836
Research and development	11,431,941	12,009,170	6,584,614	4,465,919
Selling, general and administrative	12,950,572	14,079,658	7,436,426	6,385,378
Impairment of property and equipment	—	604,511	—	—
Total operating expenses	27,961,205	32,723,851	16,865,157	13,506,176
Loss from operations	(21,168,416)	(23,218,808)	(12,948,293)	(8,347,682)
<b>Other income (expense)</b>				
Interest expense	(470,072)	(590,927)	(286,095)	(709,616)
Change in fair value of preferred stock warrants and expirations	3,006,082	751,933	953,893	2,470,921
Other expense	(203,285)	(289,010)	(57,135)	(563,179)
Total other income (expenses)	2,332,725	(128,004)	610,663	1,198,126
Loss before income taxes	(18,835,691)	(23,346,812)	(12,337,630)	(7,149,556)
Provision for income taxes	(12,924)	(18,552)	(22,358)	(9,282)
Net loss	\$ (18,848,615)	\$ (23,365,364)	\$ (12,359,988)	\$ (7,158,838)
Net loss per share, basic and diluted:	\$ (312.46)	\$ (327.78)	\$ (176.12)	\$ (92.23)
Weighted-average common shares outstanding, basic and diluted	60,323	71,283	70,178	77,618
Pro forma net loss per share, basic and diluted (unaudited)		\$ (8.65)		\$ (1.37)
Pro forma weighted-average common shares outstanding, basic and diluted (unaudited)		2,701,065		5,227,448

See accompanying notes

**Bionano Genomics, Inc.**

**Consolidated Statements of Convertible Preferred Stock and Stockholders' Deficit**

	Series A Convertible Preferred Stock		Series B Convertible Preferred Stock		Series B-1 Convertible Preferred Stock		Series C Convertible Preferred Stock		Series D Convertible Preferred Stock		Series D-1 Convertible Preferred Stock		Common Stock		Additional Paid-in Capital	Accumulated Deficit	\$
	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount			
<b>Balance at January 1, 2016</b>	1,908,757	\$ 4,989,018	17,195,333	\$ 23,909,095	7,441,599	\$ 10,359,042	37,752,481	\$ 48,930,547					103,728	\$ 10	\$ 3,509,189	\$ (93,428,106)	\$
Mandatory conversion of Series A, B and C preferred stock	(1,563,170)	(4,927,171)	(9,137,163)	(23,066,250)	(4,003,649)	(9,999,449)	(14,395,434)	(43,382,706)					679,890	68	2,849	81,376,049	
10-to-1 reverse stock split	—	—	—	—	—	—	—	—	—	—	—	—	(705,588)	(70)	(2,950)	—	
Common stock share cancellations	—	—	—	—	—	—	—	—	—	—	—	—	(8,190)	(1)	1	—	
Issuance of Series D convertible preferred stock, net of issuance cost and warrant fair value of \$5,140,463	—	—	—	—	—	—	—	—	20,652,486	4,838,379	—	—	—	—	—	—	
Issuance of Series D-1 convertible preferred stock, net of issuance cost of \$200,002	—	—	—	—	—	—	—	—	—	—	29,166,671	13,766,022	—	—	—	—	
Issuance of common stock	—	—	—	—	—	—	—	—	—	—	—	—	338	0	1,961	—	
Stock-based compensation expense	—	—	—	—	—	—	—	—	—	—	—	—	—	—	130,643	—	
Net loss	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(18,848,615)	
<b>Balance at December 31, 2016</b>	345,587	\$ 61,847	8,058,170	\$ 842,845	3,437,950	\$ 359,593	23,357,047	\$ 5,547,841	20,652,486	4,838,379	29,166,671	13,766,022	70,178	\$ 7	\$ 3,641,693	\$ (30,900,672)	\$
Issuance of Series D-1 convertible preferred stock, net of issuance cost of \$154,191	—	—	—	—	—	—	—	—	—	—	36,974,586	17,593,610	—	—	—	—	
Issuance of common stock	—	—	—	—	—	—	—	—	—	—	—	—	7,079	1	14,294	—	
Stock-based compensation expense	—	—	—	—	—	—	—	—	—	—	—	—	—	—	382,830	—	
Net loss	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(23,365,364)	
<b>Balance at December 31, 2017</b>	345,587	\$ 61,847	8,058,170	\$ 842,845	3,437,950	\$ 359,593	23,357,047	\$ 5,547,841	20,652,486	4,838,379	66,141,257	\$ 31,359,632	77,257	\$ 8	\$ 4,038,817	\$ (54,266,036)	\$
Issuance of common stock (unaudited)	—	—	—	—	—	—	—	—	—	—	—	—	788	0	1,012	—	
Stock-based compensation expense (unaudited)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	107,426	—	
Net loss (unaudited)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(7,158,838)	
<b>Balance at June 30, 2018 (unaudited)</b>	345,587	\$ 61,847	8,058,170	\$ 842,845	3,437,950	\$ 359,593	23,357,047	\$ 5,547,841	20,652,486	4,838,379	66,141,257	\$ 31,359,632	78,045	\$ 8	\$ 4,147,255	\$ (61,424,874)	\$

See accompanying notes

**Bionano Genomics, Inc.**

**Consolidated Statements of Cash Flows**

	Year Ended December 31,		Six Months Ended June 30,	
	2016	2017	2017	2018
	(unaudited)			
<b>Operating activities:</b>				
Net loss	\$(18,848,615)	\$(23,365,364)	\$(12,359,988)	\$(7,158,838)
Adjustments to reconcile net loss to cash used in operating activities:				
Depreciation and amortization expense	1,115,027	1,504,042	724,381	778,555
Change in fair value of preferred stock warrants and expirations	(3,006,082)	(751,933)	(953,893)	(2,470,921)
Stock-based compensation	130,643	382,830	217,846	107,426
Provision for bad debt expense	—	262,000	—	238,000
Inventory write-off	—	364,437	364,437	—
Impairment of property and equipment	—	604,511	—	—
Accretion of debt discount	73,902	96,576	44,682	60,655
Loss on debt extinguishment	—	—	—	342,164
Changes in operating assets and liabilities:				
Accounts receivable	(856,098)	(1,767,647)	469,869	228,009
Inventory	(726,138)	(336,046)	(665,841)	(172,578)
Prepaid expenses and other current assets	(782,217)	770,553	(371,390)	(697,361)
Accounts payable	(608,653)	1,541,472	343,725	(1,058,391)
Accrued expenses and other liabilities	11,873	(123,229)	(167,346)	49,359
Net cash used in operating activities	(23,496,358)	(20,817,798)	(12,353,518)	(9,753,921)
<b>Investing activities:</b>				
Purchases of property and equipment	(1,349,853)	(1,017,830)	(461,939)	(189,401)
Net cash used in investing activities	(1,349,853)	(1,017,830)	(461,939)	(189,401)
<b>Financing activities:</b>				
Repayment of notes payable	(5,000,000)	—	—	(7,447,571)
Proceeds from issuance of long-term debt, net of offering costs	6,886,458	—	—	9,662,430
Proceeds from issuance of convertible note, net of offering costs	—	—	—	14,329,843
Proceeds from issuance of preferred stock and warrants, net of offering costs	23,542,642	17,593,610	8,982,647	—
Proceeds received in advance of issuance of preferred stock and warrants, net of offering costs	—	—	4,249,481	—
Proceeds from option exercises	1,961	14,295	—	1,012
Net cash provided by financing activities	25,431,061	17,607,905	13,232,128	16,545,714
Net increase (decrease) in cash and cash equivalents	584,850	(4,227,723)	416,671	6,602,392
Cash and cash equivalents at beginning of period	4,664,770	5,249,620	5,249,620	1,021,897
Cash and cash equivalents at end of period	\$ 5,249,620	\$ 1,021,897	\$ 5,666,291	\$ 7,624,289
Supplementary schedule on non-cash transactions:				
Transfer of instruments to property and equipment from inventory	\$ 40,347	\$ 75,268	\$ —	\$ 106,617
Property and equipment costs incurred but not paid included in accounts payable and accrued expenses	\$ 42,670	\$ 11,830	\$ —	\$ 130,484
Leasehold improvements financed by landlord through lease incentives	\$ 1,050,244	\$ —	\$ —	\$ —
Fair value of warrants issued with equity classified as a liability	\$ 4,938,241	\$ —	\$ —	\$ —
Fair value of warrants issued with debt classified as a liability	\$ 99,684	\$ —	\$ —	\$ 176,813
Final payment fee due in connection with the repayment of debt classified within other long-term liabilities	\$ 227,500	\$ —	\$ —	\$ 400,000
Deferred equity issuance costs in accounts payable and accrued liabilities	\$ —	\$ —	\$ —	\$ 1,401,350
Debt issuance costs incurred but not paid	\$ —	\$ —	\$ —	\$ 129,474
Supplementary disclosure of cash flow information				
Interest paid	\$ 446,525	\$ 534,858	\$ 259,953	\$ 299,528

See accompanying notes



**Bionano Genomics, Inc.**

**Notes to Consolidated Financial Statements**  
**(Information as of June 30, 2018 and for the six months ended June 30, 2017 and 2018 is unaudited)**

**1. Organization and Basis of Presentation**

***Description of Business***

Bionano Genomics, Inc. (the “Company”) was incorporated in Delaware on August 16, 2007, under the name BioNanomatrix, Inc. On October 11, 2011, the Company changed its name to BioNano Genomics, Inc. Upon the filing of the Company’s amended and restated certificate of incorporation immediately prior to the closing of its public offering, the Company’s name will be changed to Bionano Genomics, Inc. The Company is developing and commercializing genomic mapping instruments and technology to enable researchers to analyze DNA through unique studies to gain a comprehensive picture of genome biology, including structural variation of DNA and chromosomes.

The accompanying consolidated financial statements (the “financial statements”) have been prepared assuming the Company will continue as a going concern, which contemplates continuity of operations, the realization of assets and the satisfaction of liabilities in the normal course of business. The financial statements do not reflect any adjustments that might result if the Company is unable to continue as a going concern. Since inception, the Company has been engaged in organizational activities, including raising capital and research and development activities. The Company has not generated substantial revenues and has not yet achieved profitable operations, nor has it ever generated positive cash flows from operations. There is no assurance that profitable operations, if achieved, could be sustained on a continuing basis. Further, the Company’s future operations are dependent on the success of the Company’s efforts to raise additional capital and the market acceptance of the Company’s products. There can be no assurance that these efforts will be successful.

***Going Concern***

In accordance with ASU 2014-15, *Presentation of Financial Statements – Going Concern (Subtopic 205-40): Disclosure of Uncertainties About an Entity’s Ability to Continue as a Going Concern*, management is required to perform a two-step analysis over its ability to continue as a going concern. Management must first evaluate whether there are conditions and events that raise substantial doubt about the Company’s ability to continue as a going concern and to meet its obligations as they become due within one year after the date that the financial statements are issued (step 1). If management concludes that substantial doubt is raised, management is also required to consider whether its plans alleviate that doubt (step 2).

The Company has experienced net losses and negative cash flows from operating activities since its inception and expects to continue to incur net losses into the foreseeable future. The Company had an accumulated deficit of \$54,266,036 and \$61,424,874 as of December 31, 2017 and June 30, 2018, respectively. The Company used \$20,817,798 cash in operations in 2017 and has used \$9,753,922 for the six months ended June 30, 2018. The Company had cash and cash equivalents of \$1,021,897 and \$7,624,289 as of December 31, 2017 and June 30, 2018, respectively. Management expects operating losses and negative cash flows to continue for at least the next year as the Company continues to incur costs related to research and commercialization efforts. Management has prepared cash flow forecasts which indicate that based on the Company’s expected operating losses and negative cash flows, there is substantial doubt about the Company’s ability to continue as a going concern within twelve months after the date that the financial statements for the year ended December 31, 2017 and the six months ended June 30, 2018, are issued.

Further, on March 8, 2016, the Company entered into a new term Loan and Security Agreement with Western Alliance Bank (the “Western Alliance LSA”). The provisions of the Western Alliance LSA allow for Western Alliance Bank to exercise a material adverse effect clause should the Company incur a material adverse effect within the meaning provided by the Western Alliance LSA, which could include the going concern matters

described herein. Should Western Alliance Bank invoke the material adverse effect clause, the outstanding loan balance may be declared immediately due and payable. The Company believes that it is a remote probability that the material adverse effect clause associated with the Western Alliance LSA will be exercised.

Management's ability to continue as a going concern is dependent upon its ability to raise additional funding. Management has plans to raise additional capital through equity offerings or debt financings to fulfill its operating and capital requirements for at least 12 months and to maintain compliance with the Western Alliance LSA covenants (see Note 7). The Company's plans include continuing to fund its operating losses and capital funding needs through public or private equity or debt financings, strategic collaborations, licensing arrangements, asset sales, or other arrangements. However, the Company may not be able to secure such financing in a timely manner or on favorable terms, if at all. Furthermore, if the Company issues equity securities to raise additional funds, its existing stockholders may experience dilution, and the new equity securities may have rights, preferences and privileges senior to those of the Company's existing stockholders. If the Company raises additional funds through collaboration, licensing or other similar arrangements, it may be necessary to relinquish valuable rights to its products or proprietary technologies or grant licenses on terms that are not favorable to the Company.

On June 29, 2018, the Company entered into a new Credit and Security Agreement with MidCap Financial Trust (the "Midcap Agreement"). The Midcap Agreement resulted in a \$10,000,000 term loan and a \$1,000,000 Convertible note. Proceeds from the Midcap Agreement were used to repay the outstanding \$7,000,000 balance on the Western Alliance LSA. The provisions of the Midcap Agreement allow for MidCap Financial Trust to exercise a material adverse effect clause should the Company incur a material adverse effect within the meaning provided by the Midcap Agreement, which could include the going concern matters described herein. Should MidCap Financial Trust invoke the material adverse effect clause, the outstanding loan balance may be declared immediately due and payable. The Company believes that it is a remote probability that the material adverse effect clause associated with the Midcap Agreement will be exercised. Management plans to continue raising capital through equity offerings and debt financings to fulfill its operating and capital requirements.

If the Company does not have or is not able to obtain sufficient funds, it may have to reduce commercialization efforts or delay its development of new products. The Company also may have to reduce marketing, customer support or other resources devoted to its products or cease operations.

## **2. Summary of Significant Accounting Policies**

### ***Use of Estimates***

The financial statements are prepared in accordance with accounting principles generally accepted in the United States ("GAAP") and all intercompany transactions and balances have been eliminated in consolidation. The preparation of the Company's financial statements require the Company to make estimates and assumptions that impact the reported amounts of assets, liabilities and expenses and the disclosure of contingent assets and liabilities in the financial statements and accompanying notes. Management evaluates its estimates on an ongoing basis. Although estimates are based on the Company's historical experience, knowledge of current events and actions it may undertake in the future, actual results may ultimately materially differ from these estimates and assumptions.

### ***Unaudited Interim Financial Information***

The accompanying consolidated balance sheet as of June 30, 2018, the related consolidated statements of operations and consolidated statements of cash flows for the six months ended June 30, 2017 and 2018 and the consolidated statements of convertible preferred stock and stockholders' deficit for the six months ended June 30, 2018 are unaudited. The interim unaudited consolidated financial statements have been prepared on the same basis as the annual audited 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 June 30, 2018 and the results of its operations and its cash flows for the six months ended

June 30, 2017 and 2018. The financial data and other information disclosed in these notes related to the six months ended June 30, 2017 and 2018 are unaudited. The results for the six months ended June 30, 2018 are not necessarily indicative of results to be expected for the year ending December 31, 2018, any other interim periods or any future year or period.

***Unaudited Pro Forma Balance Sheet Information***

The unaudited pro forma consolidated balance sheet information as of June 30, 2018 assumes the conversion of all outstanding shares of convertible preferred stock into 2,850,280 shares of the Company's common stock and the resulting reclassification of the carrying value of the convertible preferred stock to stockholders' deficit upon the completion of the Company's proposed initial public offering (the "IPO"). The unaudited pro forma consolidated balance sheet information as of June 30, 2018 also assumes the conversion of all convertible notes into 3,203,107 shares of the Company's common stock and the resulting reclassification of the carrying value of the convertible notes to stockholders' deficit upon the completion of the Company's proposed IPO. Lastly, the unaudited pro forma consolidated balance sheet information as of June 30, 2018 assumes the cancellation of the warrant liability and the resulting reclassification of the carrying value of the warrant shares to stockholders' deficit upon the completion of the Company's IPO. The unaudited pro forma consolidated balance sheet assumes that the completion of the IPO had occurred as of June 30, 2018 and excludes shares of common stock issued in the IPO and any related net proceeds.

***Reclassifications***

Certain amounts presented in the prior year financial statements have been reclassified to conform to current year presentation. Product revenue has been separated into product revenue and other revenue and cost of revenue has been separated into cost of product revenue and cost of other revenue on the consolidated statements of operations. For the year ended December 31, 2016, \$631,539 has been reclassified out of product revenue into other revenue and \$118,921 has been reclassified out of cost of product revenue into cost of other revenue.

***Cash and Cash Equivalents***

The Company considers all highly liquid investments with an original maturity of three months or less at the date of purchase to be cash equivalents. Cash equivalents primarily represent funds invested in readily available checking and money market accounts.

The Company has not experienced any losses in such accounts. The Company believes that it is not exposed to any significant credit risk on cash and cash equivalents. Included in cash and cash equivalents is \$201,623, \$252,594 and \$252,594 in restricted cash as of December 31, 2016 and 2017 and June 30, 2018, respectively, related to amounts held for leases and credit cards.

***Fair Value of Financial Instruments***

The carrying amounts of all cash equivalents, accounts receivable, prepaid expenses and other current assets, accounts payable and accrued liabilities are reasonable estimates of their fair value because of the short-term nature of these items. Company issued convertible preferred stock warrants are recorded at fair value on a recurring basis.

***Concentration of Credit Risk***

Financial instruments, which potentially subject the Company to significant concentration of credit risk, consist primarily of cash and cash equivalents and accounts receivable. The Company maintains deposits in federally insured major financial institutions in excess of federally insured limits. The Company has not experienced any losses in such accounts and management believes that the Company is not exposed to significant credit risk due to the financial position of the depository institution in which those deposits are held.

The Company's customers are located throughout the world. The Company generally does not require collateral from its customers, but it performs credit evaluations of their financial condition. More information on accounts receivable is contained in the paragraph titled "Accounts Receivable" below.

**Accounts Receivable**

The Company extends credit to its customers in the normal course of business based upon an evaluation of each customer's credit history, financial condition, and other factors. Estimates of allowances for doubtful accounts are determined by evaluating individual customer circumstances, historical payment patterns, length of time past due, and economic and other factors. Bad debt expense is recorded as necessary to maintain an appropriate level of allowance for doubtful accounts in selling, general and administrative expense.

The following table reflects the activity related to the Company's allowance for doubtful accounts:

	December 31,		June 30,
	2016	2017	2018 (unaudited)
Accounts receivable	\$ 1,846,567	\$ 3,614,214	\$ 3,386,205
Provision	—	(262,000)	(500,000)
Accounts receivable, net	<u>\$ 1,846,567</u>	<u>\$ 3,352,214</u>	<u>\$ 2,886,205</u>

For the years ended December 31, 2016 and 2017 and the six months ended June 30, 2017 and 2018, Ultravision Technology Ltd. represented 14%, 21%, 0% and 9%, BioStar Company represented 0%, 15%, 0% and 15%, Berry Genomics Corporation represented 11%, 2%, 0% and 1%, Star Research Technology LTD represented 12%, 0%, 1% and 0%, University of Oxford represented 20%, 0%, 0% and 6%, and University of Connecticut represented 12%, 0%, 0% and 0%, respectively, of the Company's accounts receivable balance.

**Inventory**

Inventory is stated at the lower of cost or net realizable value, on a first-in, first-out basis. Inventory includes raw materials and finished goods that may be used in the research and development process and such items are expensed as consumed or expired. Provisions for slow-moving, excess, and obsolete inventories are estimated based on product life cycles, historical experience, and usage forecasts.

The components of inventories are as follows:

	December 31,		June 30,
	2016	2017	2018 (unaudited)
Materials and supplies	\$ 119,329	\$ 203,085	\$ 242,783
Finished Goods	1,678,072	1,490,657	1,730,155
	<u>\$ 1,797,401</u>	<u>\$ 1,693,742</u>	<u>\$ 1,972,938</u>

Inventories are net of write-downs of approximately \$0, \$364,437 and \$364,437 as of December 31, 2016 and 2017 and June 30, 2018, respectively. During the year ended December 31, 2017, in connection with the market launch of the Company's next generation product, the Saphyr system, the Company determined that its first generation Irys instruments on hand had net realizable values below carrying value. Accordingly, the Company recorded a charge of \$364,437 included in cost of revenue to write-down these instruments to net realizable value. As of December 31, 2017, and June 30, 2018, the Company's finished goods inventory included approximately \$1,287,000 of Irys instruments.

***Property and Equipment***

Property and equipment are recorded at cost and depreciated or amortized using the straight-line method over the estimated useful lives of the assets (generally three to five years, or the remaining term of the lease for leasehold improvements, whichever is shorter) and generally consist of laboratory equipment, computer and office equipment, furniture and fixtures, and leasehold improvements. Repairs and maintenance costs are charged to expense as incurred.

***Long-Lived Assets***

The Company regularly reviews the carrying value and estimated lives of all of its long-lived assets, including property and equipment, to determine whether indicators of impairment may exist which warrant adjustments to carrying values or estimated useful lives. Should an impairment exist, the impairment loss would be measured based on the excess over the carrying amount of the asset's fair value. The Company has not recognized any impairment losses from inception through December 31, 2016. During the year ended December 31, 2017, the Company recognized an impairment loss of \$604,511 related to equipment at customer sites. No impairment losses were recognized during the six months ended June 30, 2017 and 2018.

***Deferred Rent***

Deferred rent consists of the difference between cash payments and the recognition of rent expense on a straight-line basis for the facilities the Company leases. The Company's leases for its facilities provide for fixed increases in minimum annual rental payments. The total amount of rental payments due over the lease terms are being charged to rent expense ratably over the life of the leases. The current portion of deferred rent is included in accrued expenses and the non-current portion in other non-current liabilities on the consolidated balance sheets.

***Revenue Recognition***

***Product Revenue***

Product revenue represents the sale of the Company's instruments and consumables to third parties. Timing of revenue recognition on instrument sales is based upon when delivery has occurred, the price is fixed or determinable, and collectability is reasonably assured.

The majority of our instruments contain embedded operating systems and other software which is included in the purchase price of the instrument. The software is deemed incidental to the system as a whole as it is not sold or marketed separately and its production costs are minor compared to those of the hardware system. Hardware and software elements are both delivered when ownership is transferred to the customer. Hardware upgrades, which are made available to customers for purchase, are recognized as revenue when delivered and all revenue recognition criteria noted above have been met.

Installation services for direct sale customers are performed at the same time or shortly after the product is delivered and require only a minimal effort to complete. We believe installation is a perfunctory service and is not material to our obligations in the contract.

***Other Revenue***

Other revenue includes revenue from extended service contracts and other services that may be performed. Revenue for extended warranty contracts is recognized ratably over the service period. Revenue for other services is generally recognized based on proportional performance of the contract, when the Company's ability to complete project requirements is reasonably assured. Deferred revenue represents amounts received in advance for on-going service arrangements. Most of these services are completed in a short period of time from the receipt of the customer's order. When significant risk exists in the Company's ability to fulfill project requirements, revenue is recognized upon completion of the contract.

### *Multiple Element Arrangements*

The Company regularly enters into contracts where revenue is derived from multiple deliverables, including products or services. These contracts typically include an instrument, consumables, and extended service contracts. Revenue recognition for contracts with multiple deliverables is based on the individual units of accounting determined to exist in the contract. A delivered item is considered a separate unit of accounting when the delivered item has value to the customer on a stand-alone basis. Items are considered to have stand-alone value when they are sold separately by any vendor or when the customer could resell the item on a stand-alone basis.

For transactions with multiple deliverables, consideration is allocated at the inception of the contract to all deliverables based on their relative selling price. The relative selling price for each deliverable is determined using vendor-specific objective evidence (“VSOE”) of selling price or third-party evidence of selling price if VSOE does not exist. If neither VSOE nor third-party evidence exists, the Company uses its best estimate of the selling price using average selling prices over an appropriate period coupled with an assessment of current market conditions. If the product or service has no history of sales or if the sales volume is not sufficient, the Company considers its approved standard prices adjusted for applicable discounts.

In order to establish VSOE of selling price, the Company must regularly sell the product or service on a standalone basis with a substantial majority priced within a relatively narrow range. In cases where there is not a sufficient number of standalone sales and VSOE of selling price cannot be determined, then the Company utilizes third-party evidence to establish selling price.

### *Distributor Transactions*

In certain markets, the Company sells products and provides services to customers through distributors that specialize in life sciences products. In cases where the product is delivered to a distributor, revenue recognition generally occurs when title transfers to the distributor. The terms of sales transactions through distributors are generally consistent with the terms of direct sales to customers and do not contain return rights. Distributor sales transactions typically differ from direct customer sales as they do not require the Company’s services to install the instrument at the end customer or perform the services for the customer that are beyond the standard warranty in the first year following the sale. These transactions are accounted for in accordance with the Company’s revenue recognition policy described herein.

The Company derives a significant portion of product revenue from a limited distributor base. For the years ended December 31, 2016 and 2017, and the six months ended June 30, 2017 and 2018, Berry Genomics Corp. represented 15%, 4%, 8% and 6%, Ultravision Technology Ltd. represented 11%, 15%, 8% and 6%, Gene Company Ltd. represented 0%, 6%, 14% and 13%, and AS One Corp. represented 10%, 0%, 0% and 0%, respectively, of the Company’s total revenues. No other distributor represented more than 10% of total Company revenues during these periods.

### *Cost of Revenue*

Cost of revenue for products consists of the Company’s instrument cost from the manufacturer, raw material parts costs and associated freight, shipping and handling costs, contract manufacturer costs, royalties due to third parties, salaries and other personnel costs, overhead and other direct costs related to those sales recognized as product revenue in the period.

Cost of other revenue consists of salaries and other personnel costs, and facility costs associated with costs related to warranties and other costs of servicing equipment at customer sites.

### *Research and Development Costs*

Costs incurred for research and product development, including acquired technology and costs incurred for technology in the development stage, are expensed as incurred.

***Patent Costs***

Costs related to filing and pursuing patent applications are recorded as selling, general and administrative expense and expensed as incurred since recoverability of such expenditures is uncertain.

***Deferred Offering Costs***

Deferred public offering costs primarily consist of legal, accounting and filing fees relating to the IPO. The deferred offering costs will be offset against the IPO proceeds upon the consummation of the offering. In the event the offering is delayed or aborted, incurred offering costs will be expensed. The Company has incurred \$1,436,320 of IPO costs as of June 30, 2018.

***Stock-Based Compensation***

Stock-based compensation expense represents the cost of the grant date fair value of employee stock option grants recognized over the requisite service period of the awards (usually the vesting period) on a straight-line basis, net of actual forfeitures during the period. The Company estimates the fair value of stock option grants using the Black-Scholes option pricing model. The exercise price for all stock options granted was at the estimated fair value of the underlying common stock as determined on the date of grant by the Board of Directors. The Board of Directors determined the value of the underlying stock by considering a number of factors, including historical and projected financial results, the risks the Company faced at the time, the preferences of the Company's convertible preferred stockholders, and the lack of liquidity of the Company's common stock.

***Convertible Preferred Stock Warrants***

The Company accounts for freestanding warrants to purchase shares of convertible preferred stock as liabilities in the balance sheets under preferred stock warrant liability. The convertible preferred stock warrants are subject to remeasurement at each reporting period, with changes in fair value recorded as change in fair value of warrants and expirations in the consolidated statements of operations.

***Income Taxes***

The Company accounts for income taxes under the asset and liability method, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of events that have been included in the financial statements. Under this method, deferred tax assets and liabilities are determined on the basis of the differences between the financial statements and tax basis of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. The effect of a change in tax rates on deferred tax assets and liabilities is recognized in income in the period that includes the enactment date.

The Company recognizes deferred tax assets to the extent that the Company believes these assets are more likely than not to be realized. In making such a determination, management considers all available positive and negative evidence, including future reversals of existing taxable temporary differences, projected future taxable income, tax-planning strategies, and results of recent operations. If management determines that the Company would be able to realize its deferred tax assets in the future in excess of their recorded amount, management would make an adjustment to the deferred tax asset valuation allowance, which would reduce the provision for income taxes.

As of December 31, 2016, and 2017, the Company maintained valuation allowances against its deferred tax assets as the Company concluded it had not met the "more likely than not" to be realized threshold. Changes in the valuation allowance when they are recognized in the provision for income taxes may result in a change in the estimated annual effective tax rate.

The Company recognizes the impact of uncertain tax positions at the largest amount that is “more likely than not” to be sustained upon audit by the relevant taxing authority. An uncertain tax position will not be recognized if it has less than a 50% likelihood of being sustained. The Company recognizes interest and penalties related to unrecognized tax benefits within income tax expense. Any accrued interest and penalties are included within the related tax liability.

**Comprehensive Loss**

Net loss and comprehensive loss were the same for all periods presented; therefore, a separate statement of comprehensive loss is not included in the financial statements.

**Segment Reporting**

Operating segments are identified as components of an enterprise about which separate discrete financial information is available for evaluation by the chief operating decision-maker in making decisions regarding resource allocation and assessing performance. The Company and its chief operating decision-maker, the Chief Executive Officer, views the Company’s operations and manages its business in one operating segment.

The following table reflects total revenue by geography and as a percentage of total revenue, based on the billing address of the Company’s customers. North America consists of the United States and Canada. EMEIA consists of Europe, the Middle East, India and Africa. Asia Pacific includes China, Japan, South Korea, Singapore and Australia.

	Year Ended December 31,				Six months ended June 30,			
	2016		2017		2017		2018	
	\$	%	\$	%	\$	%	\$	%
North America	\$2,078,987	31%	\$3,801,481	40%	\$1,794,728	46%	\$2,553,428	49%
EMEIA	1,666,188	24%	1,282,897	13%	819,464	21%	1,128,510	22%
Asia Pacific	3,047,614	45%	4,420,665	47%	1,302,672	33%	1,476,556	29%
Total	<u>\$6,792,789</u>	<u>100%</u>	<u>\$9,505,043</u>	<u>100%</u>	<u>\$3,916,864</u>	<u>100%</u>	<u>\$5,158,494</u>	<u>100%</u>

Subsequent to the issuance of the June 30, 2018 unaudited condensed consolidated financial statements, the Company discovered an error in the disclosure of revenue amounts for the six months ended June 30, 2018 within the North America, EMEIA and Asia Pacific geographic regions. Accordingly, the table above has been restated to correct the June 30, 2018 disclosures of revenue for the North America, EMEIA, and Asia Pacific geographic regions, resulting in increases (decreases) from amounts previously reported of \$837,451, \$239,421, and \$(1,076,872), respectively.

For the years ended December 31, 2016 and 2017, and the six months ended June 30, 2017 and 2018, the United States represented 30%, 37%, 46% and 50% and China represented 34%, 28%, 16% and 23%, respectively of total revenue.

**Net Loss Per Share**

Basic net loss per share is calculated by dividing the net loss by the weighted-average number of common shares outstanding for the period. Diluted net loss per share is computed by dividing the net loss by the weighted average number of common shares and common share equivalents outstanding for the period. Common stock equivalents are only included when their effect is dilutive. The Company’s potentially dilutive securities which include convertible preferred stock and outstanding stock options under the Company’s equity incentive plan have been excluded from the computation of diluted net loss per share as they would be anti-dilutive to the net loss per share. For all periods presented, there is no difference in the number of shares used to calculate basic and diluted shares outstanding due to the Company’s net loss position.



Potentially dilutive securities not included in the calculation of diluted net loss per share attributable to common stockholders because to do so would be anti-dilutive are as follows (in common stock equivalent shares):

	Year Ended December 31,		Six months ended June 30,	
	2016	2017	2017	2018
			(unaudited)	
Series A convertible preferred stock	8,074	8,074	8,074	8,074
Series B convertible preferred stock	188,275	188,275	188,275	188,275
Series B-1 convertible preferred stock	80,327	80,327	80,327	80,327
Series C convertible preferred stock	545,728	545,728	545,728	545,728
Series D convertible preferred stock	482,529	482,529	482,529	482,529
Series D-1 convertible preferred stock	681,448	1,545,347	1,328,828	1,545,347
Common Stock Options	43,596	436,341	447,518	416,937
Preferred Warrants	856,921	855,212	856,921	869,814
<b>Total</b>	<b>2,886,898</b>	<b>4,141,833</b>	<b>3,938,200</b>	<b>4,137,031</b>

**Unaudited Pro Forma Net Loss Per Share**

	Year Ended	Six months ended
	December 31, 2017	June 30, 2018
	(unaudited)	
Net loss and pro forma net loss attributable to common stockholders	\$ (23,365,364)	\$ (7,158,858)
Weighted-average common shares outstanding, basic and diluted	71,283	77,618
Add:		
Pro forma adjustments to reflect assumed conversion of convertible preferred stock	2,629,782	5,149,830
Pro forma weighted-average common shares outstanding, basic and diluted	2,701,065	5,227,448
Pro forma net loss per share attributable to common stockholders, basic and diluted	\$ (8.65)	\$ (1.37)

**Recent Accounting Pronouncements**

On April 5, 2012, President Obama signed the Jump-Start Our Business Startups Act (the “JOBS Act”) into law. The JOBS Act contains provisions that, among other things, reduce certain reporting requirements for an emerging growth company. As an emerging growth company, the Company may elect to adopt new or revised accounting standards when they become effective for non-public companies, which typically is later than when public companies must adopt the standards. The Company has elected to take advantage of the extended transition period afforded by the JOBS Act and, as a result, will comply with new or revised accounting standards on the relevant dates on which adoption of such standards is required for emerging growth companies, which are the dates included below.

In May 2014, the FASB issued ASU 2014-09, *Revenue from Contracts with Customers (Topic 606)*. ASU 2014-09 completes the joint effort by the FASB and International Accounting Standards Board to improve financial reporting by creating common revenue recognition guidance for GAAP and International Financial Reporting Standards. ASU 2014-09 applies to all companies that enter into contracts with customers to transfer goods or services. Under the standard, revenue is recognized when a customer obtains control of promised goods or services in an amount that reflects the consideration the entity expects to receive in exchange for those goods or services. In addition, the standard requires disclosure of the nature, amount, timing, and uncertainty of revenue and cash flows arising from contracts with customers. The guidance permits two methods of adoption: retrospectively to each prior reporting period presented (full retrospective method), or retrospectively with the cumulative effect of initially applying the guidance recognized at the date of initial application (modified

retrospective method). The guidance is effective for reporting periods beginning after December 15, 2018, and interim periods beginning after December 15, 2019. The Company has evaluated this new guidance and does not expect the adoption to have a material impact on the financial statements.

In February 2015, the FASB issued ASU 2016-02, *Leases (Topic 842)*, which amends the FASB Accounting Standards Codification and creates Topic 842, "Leases." The new topic supersedes Topic 840, "Leases," and increases transparency and comparability among organizations by recognizing lease assets and lease liabilities on the balance sheet and requires disclosures of key information about leasing arrangements. The guidance is effective for reporting periods beginning after December 15, 2019, and interim periods within fiscal years beginning after December 15, 2020. ASU 2016-02 mandates a modified retrospective transition method. The Company is in the process of evaluating the impact of adoption of the ASU on the financial statements.

In January 2016, the FASB issued ASU No. 2016-01, *Financial Instruments—Overall (Subtopic 825-10): Recognition and Measurement of Financial Assets and Financial Liabilities (ASU 2016-01)*. This guidance changes how entities measure equity investments that do not result in consolidation and are not accounted for under the equity method. Entities will be required to measure these investments at fair value at the end of each reporting period and recognize changes in fair value in net income. A practicability exception will be available for equity investments that do not have readily determinable fair values, however; the exception requires the Company to consider relevant transactions that can be reasonably known to identify any observable price changes that would impact the fair value. This guidance also changes certain disclosure requirements and other aspects of current GAAP. This guidance is effective for the Company for the year ending December 31, 2019 and for interim periods effective the three months ending March 31, 2020. Early adoption is permitted. The Company is currently evaluating the requirements of ASU 2016-01 and has not yet determined whether the adoption of the standard will have a material impact on the financial statements.

In August 2016, the FASB issued ASU 2016-15, *Classification of Certain Cash Receipts and Cash Payments (Topic 230)*. ASU 2016-15 addresses eight specific cash flow issues with the objective of reducing the existing diversity in practice for certain cash receipts and cash payments. The standard is effective for annual reporting periods beginning after December 15, 2018 and interim periods reporting within fiscal years beginning after December 15, 2019, with early adoption permitted. The Company does not believe the adoption of this guidance will have a material impact on the financial statements.

### **3. Fair Value Measurements**

The accounting guidance defines fair value, establishes a consistent framework for measuring fair value and expands disclosure for each major asset and liability category measured at fair value on either a recurring or nonrecurring basis. Fair value is defined as an exit price, representing the amount that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants. As such, fair value is a market-based measurement that should be determined based on assumptions that market participants would use in pricing an asset or liability. As a basis for considering such assumptions, the accounting guidance establishes a three-tier fair value hierarchy, which prioritizes the inputs used in measuring fair value as follows:

Level 1: Unadjusted quoted prices in active markets that are accessible at the measurement date for identical, unrestricted assets or liabilities.

Level 2: Quoted prices for similar assets and liabilities in active markets, quoted prices in markets that are not active, or inputs which are observable, either directly or indirectly, for substantially the full term of the asset or liability.

Level 3: Prices or valuation techniques that require inputs that are both significant to the fair value measurement and unobservable (i.e. supported by little or no market activity).

	<u>December 31,</u> <u>2016</u>	<u>Fair Value Measurement Using</u>		
		<u>Quoted Prices</u> <u>in Active</u> <u>Markets for</u> <u>Identical Assets</u> <u>Level 1</u>	<u>Significant</u> <u>Other</u> <u>Observable</u> <u>Inputs</u> <u>Level 2</u>	<u>Significant</u> <u>Unobservable</u> <u>Inputs</u> <u>Level 3</u>
<b>Assets</b>				
Money market funds	\$ 5,249,620	\$ 5,249,620	\$ —	\$ —
Total assets	<u>\$ 5,249,620</u>	<u>\$ 5,249,620</u>	<u>\$ —</u>	<u>\$ —</u>
<b>Liabilities</b>				
Preferred stock warrant liability	\$ 4,650,877	\$ —	\$ —	\$ 4,650,877
Total liabilities	<u>\$ 4,650,877</u>	<u>\$ —</u>	<u>\$ —</u>	<u>\$ 4,650,877</u>

	<u>December 31,</u> <u>2017</u>	<u>Fair Value Measurements Using</u>		
		<u>Quoted Prices</u> <u>in Active</u> <u>Markets for</u> <u>Identical Assets</u> <u>Level 1</u>	<u>Significant</u> <u>Other</u> <u>Observable</u> <u>Inputs</u> <u>Level 2</u>	<u>Significant</u> <u>Unobservable</u> <u>Inputs</u> <u>Level 3</u>
<b>Assets</b>				
Money market funds	\$ 1,021,897	\$ 1,021,897	\$ —	\$ —
Total assets	<u>\$ 1,021,897</u>	<u>\$ 1,021,897</u>	<u>\$ —</u>	<u>\$ —</u>
<b>Liabilities</b>				
Preferred stock warrant liability	\$ 3,898,944	\$ —	\$ —	\$ 3,898,944
Total liabilities	<u>\$ 3,898,944</u>	<u>\$ —</u>	<u>\$ —</u>	<u>\$ 3,898,944</u>

	<u>June 30,</u> <u>2018</u>	<u>Fair Value Measurements Using</u>		
		<u>Quoted Prices</u> <u>in Active</u> <u>Markets for</u> <u>Identical Assets</u> <u>Level 1</u>	<u>Significant</u> <u>Other</u> <u>Observable</u> <u>Inputs</u> <u>Level 2</u>	<u>Significant</u> <u>Unobservable</u> <u>Inputs</u> <u>Level 3</u>
(unaudited)				
<b>Assets</b>				
Money market funds	\$ 7,624,289	\$ 7,624,289	\$ —	\$ —
Total assets	<u>\$ 7,624,289</u>	<u>\$ 7,624,289</u>	<u>\$ —</u>	<u>\$ —</u>
<b>Liabilities</b>				
Preferred stock warrant liability	\$ 1,604,836	\$ —	\$ —	\$ 1,604,836
Total liabilities	<u>\$ 1,604,836</u>	<u>\$ —</u>	<u>\$ —</u>	<u>\$ 1,604,836</u>

The following table summarizes the changes in fair value of the Company's Level 3 liabilities for the years ended December 31, 2016 and 2017, and the six months ended June 30, 2018:

	<u>Warrant Liability</u>
Balance at January 1, 2016	\$ 2,619,034
Issuance of warrants in connection with debt	99,684
Issuance of warrants in connection with equity	4,938,241
Expiration of Series C warrants	(1,113,633)
Change in fair value of preferred stock warrants	(1,892,449)
Balance at December 31, 2016	4,650,877
Expiration of Series A warrants	(1,424)
Change in fair value of preferred stock warrants	(750,509)
Balance at December 31, 2017	3,898,944
Issuance of warrants in connection with debt (unaudited)	176,813
Change in fair value of preferred stock warrants (unaudited)	\$ (2,470,921)
Balance at June 30, 2018 (unaudited)	<u>\$ 1,604,836</u>

As of December 31, 2013, the Company classified certain warrants to purchase Series A convertible preferred stock that contain down-round protection provisions as a liability. In connection with the Series C Convertible Participating Preferred Stock and Warrant Purchase Agreement in 2014, the composition of the Company's Board of Directors changed such that the holders of the Series A, B, B-1 and C convertible preferred stock controlled the Board of Directors. Accordingly, upon certain change in control events that are outside of the Company's control, including liquidation, sale, or transfer of control of the Company, holders of the convertible preferred stock can cause its redemption. As such, the then outstanding warrants to purchase shares of Series B and B-1 convertible preferred stock that were previously classified in equity at the time of the Series C Convertible Participating Preferred Stock and Warrant Purchase Agreement were reclassified to a liability at fair value. As of June 30, 2018, holders of the convertible preferred stock continue to control the Board of Directors.

The warrants to purchase shares of Series C convertible preferred stock issued in 2014 expired during the year ending December 31, 2016. In connection with the Series D Convertible Participating Preferred Stock and Warrant Purchase Agreement in 2016 (see Note 8), the Company issued warrants to purchase Series D convertible preferred stock which are classified as a liability. In connection with the Western Alliance LSA and subsequent amendment, the Company issued warrants to purchase Series D and D-1 convertible preferred stock which are classified as a liability (see Note 7).

The warrants to purchase convertible preferred stock are valued at each reporting period using the Black-Scholes-Merton model. This valuation includes observable inputs such as risk-free rate, as well as unobservable inputs for assumed volatility, the expected life of the warrants, and the fair value of the underlying convertible preferred stock. Quantitative information relating to unobservable inputs is disclosed below:

	<u>December 31,</u>		<u>June 30,</u>
	<u>2016</u>	<u>2017</u>	<u>2018</u>
Risk-free interest rate	0.90%	1.75%	2.32%
Volatility	54.40%	54.60%	47.20%
Expected life (in years)	0.7-1.2	0.6	0.2
Dividend Yield	—	—	—
Fair value of Series A preferred stock	\$ 0.67	\$ 0.66	\$ 0.49
Fair value of Series B-1 preferred stock	\$ 0.37	\$ 0.36	\$ 0.36
Fair value of Series D preferred stock	\$ 0.48	\$ 0.48	\$ 0.42
Fair value of Series D-1 preferred stock	\$ 0.48	\$ 0.48	\$ 0.42

At December 31, 2016 and 2017, the fair value of the underlying convertible preferred stock was determined using an Option Pricing Method (“OPM”). Under the OPM, once the fair market value of the enterprise is established, shares are valued by creating a series of call options with exercise prices based on the liquidation preference and conversion behavior of the different classes of equity. Accordingly, the aggregate equity value is allocated to each of the classes of equity shares outstanding. At June 30, 2018, the fair value of the underlying convertible preferred stock was determined using a probability-weighted expected return model (the “PWERM”) that incorporated two allocation methods: an initial public offering (the “IPO Scenario”) and an OPM to project future outcomes of the Company should the Company remain private in the near term (the “Private Scenario”). In the PWERM IPO Scenario, the probability weighting was 50%, and in the Private Scenario, the probability weighting was 50%. The Company utilizes both the market and income approach to establish the fair market value of the enterprise.

Significant increases or decreases in any of these inputs in isolation (including those inputs utilized in the OPM or those in weighted the scenarios in the PWERM) would result in a significantly different fair value measurement. An increase in the risk-free interest rate, and/or an increase in the remaining contractual term or expected volatility, and/or an increase in the fair value of the convertible preferred stock would result in an increase in the fair value of the warrants.

During the year ended December 31, 2016, the Company modified the provisions of its outstanding Series A, B and C convertible preferred stock resulting in the shares outstanding being remeasured at fair value (see Note 8). The Company utilized the OPM to determine the value of each class of convertible preferred stock at the time of remeasurement.

#### 4. Prepaid Expenses and Other Current Assets

Prepaid expenses and other current assets consist of the following:

	<u>December 31,</u>		<u>June 30,</u>
	<u>2016</u>	<u>2017</u>	<u>2018</u>
Prepayment to supplier	\$ 1,039,565	\$ 492,330	\$ 1,118,857
Deferred offering costs	—	—	1,436,320
Other current assets	802,501	579,182	615,046
Total	<u>\$ 1,842,066</u>	<u>\$ 1,071,512</u>	<u>\$ 3,170,223</u>

**5. Property and Equipment, net**

Property and equipment, net consist of the following:

	December 31,		June 30,
	2016	2017	2018 (unaudited)
Computer and office equipment	\$ 476,402	\$ 476,402	\$ 476,402
Lab equipment	3,252,020	3,995,731	4,156,519
Service equipment placed at customer sites	946,006	594,553	594,553
Leasehold improvements	1,795,178	1,860,667	1,860,667
	6,469,606	6,927,353	7,088,141
Less accumulated depreciation and amortization	(2,417,523)	(3,921,565)	(4,647,640)
	<u>\$ 4,052,083</u>	<u>\$ 3,005,788</u>	<u>\$ 2,440,501</u>

The Company recorded depreciation and amortization expense of \$1,115,027, \$1,504,042, \$724,381 and \$778,555 for the years ended December 31, 2016 and 2017 and the six months ended June 30, 2017 and 2018, respectively in operating expenses.

**6. Accrued Expenses**

Accrued expenses consist of the following:

	December 31,		June 30,
	2016	2017	2018 (unaudited)
Accrued expenses	\$ 2,246,071	\$ 2,596,137	\$ 3,032,139
Accrued offering costs	—	—	1,059,053
Accrued bonus	640,655	912,757	407,681
	<u>\$ 2,886,726</u>	<u>\$ 3,508,894</u>	<u>\$ 4,498,873</u>

**7. Long-Term Debt**

**Square 1 LSA**

In 2012, the Company amended the Loan and Security Agreement with Square 1 Bank (the “Square 1 LSA”) for a \$5,000,000 term loan in two tranches (Tranche I and Tranche II, up to \$2,000,000 and \$3,000,000, respectively) with interest at the prime rate plus 2.50%. The Company drew on Tranche I and Tranche II on June 24, 2013, and July 30, 2013, respectively, after which interest-only payments were due through December 11, 2014, as amended in August 2014, followed by principal payments of \$277,778 plus interest per month due in 18 installments beginning in January 14, 2015. The Company began to make principal payments, as required, starting January 2015. In March 2016, the Company repaid the Square 1 LSA as part of entering into the Western Alliance LSA as discussed below.

**Western Alliance LSA**

On March 8, 2016, the Company entered into the Western Alliance LSA for \$7,000,000. The loan proceeds were used to repay the outstanding \$5,000,000 loan with Square 1 Bank, as required by the 12th amendment to the Square 1 LSA.

The Western Alliance LSA bears a floating interest rate at the 30-day LIBOR Rate plus 6.52% and will amortize in 30 equal monthly installments beginning on the amortization date described below. The Western

Alliance LSA is secured by substantially all assets of the Company and matures on April 1, 2020. The Western Alliance LSA is interest-only until July 8, 2018, which may be extended to October 8, 2018 if the Company is able to secure \$21,000,000 in funding prior to June 30, 2018. The Company paid debt issuance costs and a facility fee totaling \$113,542 at the inception of the loan, which was recorded as a debt discount and is being recognized as additional interest expense over the term of the loan. Subject to certain limited exceptions, amounts prepaid in relation to the Western Alliance LSA are subject to a prepayment fee based on the then outstanding balance equal to 3% in the first year, 2% in the second year, and 1% thereafter. In addition, upon repayment of the total amounts borrowed, the Company will be required to pay an end of term charge equal to 3.25% of the total amount borrowed. Accordingly, an end of term charge of \$227,500 was recorded as debt discount and is included in other long-term liabilities on the balance sheet as of December 31, 2016 and under current liabilities as of December 31, 2017. The end of term charge is being recognized as additional interest expense over the term of the loan.

Additionally, in conjunction with the entry into Western Alliance LSA, the Company issued to Western Alliance Bank a warrant to purchase 510,417 shares of Series D convertible preferred stock at an exercise price of \$0.48 per share that was immediately exercisable and expires March 8, 2026. The Company valued the warrant to purchase Series D convertible preferred stock using the Black-Scholes-Merton model, and the initial fair value of the warrant to purchase Series D convertible preferred stock of \$65,384 was recorded as a debt discount and is being amortized to interest expense over the term of the loan. The assumptions used in the model were: the fair value of the Series D convertible preferred stock, which was determined using an OPM analysis (see Note 3), an expected life of 2 years, a risk-free interest rate of 0.88% and an expected volatility of 47%.

On December 9, 2016, the Western Alliance LSA was amended, requiring the Company to secure \$5,000,000 in funding prior to April 30, 2017 and to secure \$15,000,000 in funding between December 1, 2016 and October 8, 2017. In conjunction with this amendment, the Company issued to Western Alliance Bank a warrant to purchase 291,667 shares of Series D-1 convertible preferred stock that were immediately exercisable, expiring December 9, 2026. The Company valued the warrant to purchase Series D-1 convertible preferred stock using the Black-Scholes-Merton model, and the initial fair value of the warrant to purchase Series D-1 convertible preferred stock of \$34,300 was recorded as a debt discount and is being amortized to interest expense over the term of the loan. The assumptions used in the model were: the fair value of the Series D-1 convertible preferred stock, which was determined using an OPM analysis (see Note 3), an expected life of 1.2 years, a risk-free interest rate of 0.85% and an expected volatility of 55%.

On November 20, 2017, the Western Alliance LSA was amended requiring the Company to secure \$1,500,000 in funding prior to November 20, 2017 and to secure \$15,000,000 in funding prior to December 31, 2017. In conjunction with this amendment, the Company agreed to pay an amendment fee of \$17,500, which is payable on the earliest to occur of the loan maturity date or the prepayment date. The amount was recorded as a debt discount on the balance sheet and is being recognized as additional interest expense over the remaining term of the loan.

Under the terms of the amended Western Alliance LSA, the Company is subject to operational covenants, including limitations on the Company's ability to incur liens or additional debt, pay dividends, and redeem stock, among other restrictions. The Company is subject to a performance to plan and minimum liquidity financial covenants. The performance to plan restriction requires that the Company's actual trailing six-month revenues, as of any date of determination, shall be no less than seventy-five percent (75%) of projected revenues (the "Revenue Covenant"), as set forth in the Western Alliance LSA. However, the Company is not required to comply with the Revenue Covenant as long as the Company at all times maintains a ratio of its minimum unrestricted cash balance with Western Alliance Bank to its indebtedness with Western Alliance Bank of at least 0.75 to 1.00. As of December 31, 2016, and 2017, the Company was in compliance with its operational covenants.

The Company received a notice of default from Western Alliance Bank notifying the Company that it was in default as of December 31, 2017, as it had failed to secure at least \$15,000,000 from the sale or issuance of its

equity securities or subordinated debt as set forth in the amended Western Alliance LSA. Based on the notice of default the Company reclassified the total loan balance of \$6,729,752 to current liabilities on the consolidated balance sheet as of December 31, 2017, as the loan could be called at any time by Western Alliance Bank.

In February 2018, the Western Alliance LSA was amended requiring the Company to secure \$21,000,000 in funding prior to June 30, 2018. As part of the amendment, Western Alliance Bank agreed to forbear from exercising any of its default remedies set forth in the Western Alliance LSA as a result of the Company's loan default.

On June 13, 2018, the Western Alliance LSA was amended, replacing previously amended funding requirements and requiring the Company to secure \$5,000,000 in funding prior to August 3, 2018. Additionally, the amendment restricted Company use of all cash collected from customers, received on and after amendment date, until collecting a total of \$2,500,000. As part of the amendment, Western Alliance Bank waived the existing default.

#### ***MidCap Financial CSA***

On June 29, 2018, the Company entered into a Credit and Security Agreement (CSA) with MidCap Financial Trust which provides a \$15,000,000 term loan facility available in three tranches, Tranche 1: \$10,000,000, Tranche 2: \$2,500,000, and Tranche 3: \$2,500,000. The Company borrowed \$10,000,000 from Tranche 1 immediately upon closing the agreement; Tranches 2 and 3 are available to draw from after achieving \$12,500,000 and \$16,000,000 in trailing twelve month revenue, respectively. Proceeds from the loan were used to repay the outstanding \$7,000,000 due to Western Alliance LSA.

The MidCap Financial CSA bears interest at an annual rate of one month LIBOR plus 7.5%, subject to a LIBOR floor of 1.5%. The loan has a 60-month term, with interest only for the first 18 months and straight-line amortization of principal and interest for the remaining 42 months. The interest only period will be extended by six months following successful completion of an initial public offering that generates not less than \$30,000,000 of net proceeds. The CSA is secured by substantially all of the assets of the Company and matures on July 1, 2023.

The Company paid issuance fees of approximately \$338,000 at the inception of the loan, which was recorded as a debt discount and is being recognized as additional interest expense over the term of the loan. Subject to certain limited exceptions, amounts prepaid in relation to the MidCap Financial CSA are subject to a prepayment fee determined by multiplying the amount being prepaid by 4% in the first year of the term, 3% in year two, and 2% thereafter. In addition, upon repayment of the total amounts borrowed, the Company will be required to pay an end of term charge equal to 4% of the total amount borrowed. Accordingly, an end of term charge of \$400,000 was recorded as debt discount and is included in other long-term liabilities on the balance sheet as of June 30, 2018. The end of term charge is being recognized as additional interest expense over the term of the loan.

In conjunction with entering into the MidCap Financial CSA, the Company issued to MidCap a warrant to purchase 625,000 shares of Series D-1 convertible preferred stock at an exercise price of \$0.48 per share that was immediately exercisable and expires June 29, 2028. The Company valued the warrant to purchase Series D convertible preferred stock using the Black-Scholes-Merton model, and the initial fair value of the warrant to purchase Series D-1 convertible preferred stock of \$176,813 was recorded as a debt discount and is being amortized to interest expense over the term of the loan. The assumptions used in the model were: the fair value of the Series D-1 convertible preferred stock, which was determined using an OPM analysis (see Note 3), an expected life of 10 years, a risk-free interest rate of 2.83% and an expected volatility of 59%. In addition, MidCap invested \$1,000,000 in the convertible note offering at terms identical to other investors described in the Convertible Notes section below.



### **Convertible Notes**

On February 9, 2018, the Company entered into a Note Purchase Agreement (the “Note Purchase Agreement”) with various investors, which included related parties (the “Investors”), pursuant to which the Company agreed to sell to the Investors convertible promissory notes (the “Convertible Notes”) in the original principal amount of up to \$15,960,000. On April 2, 2018, the Company amended the Note Purchase Agreement to, among other things, increase the principal amount available for issuance under the Note Purchase Agreement to \$18,372,132. The Convertible Notes have a maturity date of September 30, 2018 and are convertible either into the Company’s common stock or convertible preferred stock, dependent on the conversion events as described below.

On June 29, 2018, the Note Purchase Agreement was amended to increase the principal amount available for issuance from \$18,372,132 to \$19,372,132.

As of June 30, 2018, the Company received proceeds of approximately \$14,400,000 from the issuance of the Convertible Notes.

### **Conversion and Liquidity Events**

**Conversion at Qualifying financing** – Upon the closing of an equity financing following the date of the Note Purchase Agreement involving the sale by the Company of its convertible preferred stock in which the Company receives an aggregate of at least \$15,000,000 in cumulative gross proceeds the conversion price will equal (i) for the Convertible Notes issued in February 2018, 75% of the lowest per share cash purchase price of the convertible preferred stock sold by the Company in such qualified financing and (ii) for the Convertible Note issued in June 2018, 80% of the lowest per share cash purchase price of the convertible preferred stock sold by the Company in such qualified financing. The original principal amount and accrued interest under each Convertible Note (the “Conversion Amount”) shall automatically convert into convertible preferred stock.

**Conversion at Initial Public Offering** – Prior to the maturity date if the Company completes an IPO the Conversion Amount will automatically convert into shares of the Company’s common stock at an amount equal to the Conversion Amount divided by (i) for the Convertible Notes issued in February 2018, 75% of either the per share cash purchase price of the common stock offered to the public in the IPO or the per unit cash purchase price of the units offered to the public in the IPO, as applicable, and (ii) for the Convertible Note issued in June 2018, 80% of either the per share cash purchase price of the common stock offered to the public in the IPO or the per unit cash purchase price of the units offered to the public in the IPO, as applicable.

**Optional Conversion at Maturity** – Upon maturity, and at the election of the Convertible Note holder, the Conversion Amount will convert into shares of Series D-2 convertible preferred stock as is equal to the Conversion Amount divided by the price per share. The price per share is defined as \$60,000,000 divided by the aggregate number of outstanding shares of the Company’s common stock as of the maturity date.

**Liquidity Event** – Upon a liquidation event or deemed liquidation event, the holders of the Convertible Notes will be entitled to receive repayment in an amount equal to (i) for the Convertible Notes issued in February 2018, 250% of the outstanding principal amount underlying the Convertible Notes and any unpaid interest accrued and outstanding and (ii) for the Convertible Note issued in June 2018, 200% of the outstanding principal amount underlying the Convertible Notes and any unpaid interest accrued and outstanding.

The Company evaluated the embedded conversion features within the above convertible notes under ASC 815-10 and ASC 815-15 to determine if they required bifurcation as a derivative instrument. The Company determined the embedded conversion features do not meet the definition of a derivative, and therefore, do not require bifurcation from the host instrument. Since the embedded conversion features were not considered derivatives, the convertible notes were accounted for accordance with ASC 470-20, Debt with Conversion and Other Options.

Debt and unamortized discount balances relating to the Western Alliance LSA are as follows:

	December 31,		June 30,
	2016	2017	2018 (unaudited)
Term loan face value	\$7,000,000	\$7,000,000	\$ —
Fair value of warrant	(99,684)	(99,684)	
End of term charge	(227,500)	(227,500)	
Capitalized debt issuance costs	(113,542)	(131,042)	
Accretion of debt issuance costs and end of term charge	60,785	148,225	
Accretion of warrant fair value	13,117	39,753	
Balance	<u>6,633,176</u>	<u>6,729,752</u>	
Less current portion	587,131	6,729,752	
Long-term debt	<u>\$6,046,045</u>	<u>\$ —</u>	<u>\$ —</u>

Debt and unamortized discount balances relating to the MidCap Financial CSA are as follows:

	June 30, 2018 (unaudited)
Term loan face value	\$10,000,000
Fair value of warrant	(176,813)
End of term charge	(400,000)
Capitalized debt issuance costs	(467,044)
Accretion of debt issuance costs and end of term charge	—
Accretion of warrant fair value	—
Balance	<u>8,956,143</u>
Less current portion	—
Long-term debt	<u>\$ 8,956,143</u>

Debt and unamortized discount balances relating to the convertible notes are as follows:

	June 30, 2018 (unaudited)
Convertible notes face value	\$ 14,372,132
Capitalized debt issuance costs	(42,289)
Balance	<u>14,329,843</u>
Less current portion	<u>14,329,843</u>
Long-term debt	<u>\$ —</u>

Non-cash interest expense related to debt discount amortization and accretion of end of term fees was \$73,902, \$96,576, \$44,682 and \$69,791 for the years ended December 31, 2016 and 2017 and six months ended June 30, 2017 and 2018, respectively.

Future minimum payments including interest under the loan and security agreement are as follows as of December 31, 2017:

Total minimum loan payments	\$ 8,426,862
Unamortized interest	(1,199,362)
End of term charge	(227,500)
Warrant fair value	(59,931)
Capitalized debt issuance costs and end of term charge	(210,317)
Term loan	<u>\$ 6,729,752</u>

Future minimum payments including interest under the MidCap Financial CSA are as follows as of June 30, 2018:

	<b>(unaudited)</b>
Years ending December 31,	
2018	\$ 479,607
2019	959,213
2020	3,690,745
2021	3,416,684
2022-2023	5,011,160
Total minimum loan payments	<u>\$13,557,409</u>
Unamortized interest	(3,157,409)
End of term charge	(400,000)
Warrant fair value	(176,813)
Capitalized debt issuance costs and end of term charge	(867,044)
Term loan	<u>8,956,143</u>
Less current portion	<u>—</u>
Long-term debt	<u>\$ 8,956,143</u>

## 8. Convertible Preferred Stock and Stockholders' Deficit

### *Convertible Preferred Stock*

The Company's convertible preferred stock has been classified as temporary equity on the accompanying balance sheets in accordance with authoritative guidance for the classification and measurement of redeemable securities. Upon certain change in control events that are outside of the Company's control, including liquidation, sale or transfer of control of the Company, holders of the convertible preferred stock can cause its redemption. There were 121,992,497 shares of convertible preferred stock outstanding as of December 31, 2017 and June 30, 2018, respectively.

The following sets forth information regarding all convertible preferred stock securities sold since January 1, 2016:

### *Series D Convertible Preferred Stock Financing*

Between March 4, 2016 and April 4, 2016, the Company issued an aggregate of 20,652,486 shares of Series D convertible preferred stock at a purchase price of \$0.48 per share, raising approximately \$9,700,000, net of share issuance costs of \$202,222, excluding the warrant liability discussed below. In conjunction with the Series D convertible preferred stock offering, the Company issued warrants to purchase an aggregate of 31,672,817 of

Series D convertible preferred stock. The Company determined that the warrants met the definition of freestanding financial instruments. Accordingly, the fair value of the warrants was recognized as a liability with an offsetting net deduction to convertible preferred stock. The Company valued the Series D convertible preferred stock warrants using the Black-Scholes-Merton model, and the initial fair value was determined to be \$4,938,241. The assumptions used in the model included the fair value of the Series D convertible preferred stock of \$0.48, an expected life of 1.9 to 2 years, a risk-free interest rate of 0.74% to 0.88% and an expected volatility of 47%.

#### *Series D-1 Convertible Preferred Stock Financing*

Between August 5, 2016 and August 29, 2016, the Company issued an aggregate of 29,166,671 shares of Series D-1 convertible preferred stock at \$0.48 per share, raising approximately \$13,800,000, net of share issuance costs of \$200,002.

From February through November 2017, the Company sold and issued 36,974,586 shares of Series D-1 convertible preferred stock at \$0.48 per share, raising approximately \$17,590,000, net of issuance costs of \$154,191. At any time after December 31, 2021, the holders of a majority of the then outstanding Series D-1 convertible preferred stock may redeem any unconverted or unredeemed Series D-1 convertible preferred stock in cash at the greater of the original convertible preferred stock purchase price plus all declared but unpaid dividends or the fair market value. The Company has determined not to adjust the carrying values of the Series D-1 convertible preferred stock to the liquidation preferences of such shares because of the uncertainty over whether or when such an event would occur. The Company has determined that it is not probable that such redemption will occur as a mandatory conversion event, as described below, is expected in advance of the redemption triggers.

#### *Convertible Preferred Stock*

The Series A, B, B-1, C, D and D-1 convertible preferred stock (collectively, the “Series Preferred”) have the following rights and privileges:

##### *Voting rights*

Series Preferred stockholders are entitled to cast the number of votes equal to the number of whole shares of common stock into which the convertible preferred stock is convertible.

##### *Conversion*

Each 42.8 shares of Series Preferred is convertible, at any time, into one share of common stock at the then-applicable Conversion Price (as defined below). The Series Preferred is automatically converted into common stock, at the then-applicable Conversion Price, upon (a) the vote or consent of 66-2/3% of the outstanding shares of Series Preferred or (b) upon the closing of the sale to the public of either shares of common stock or units comprised of shares of common stock and warrants to purchase shares of common stock (i) in which the price per share paid by the public (prior to the deduction of underwriting discounts and registration expenses) is no less than \$6.00 per share, or to the extent units are sold in such offering, no less than \$6.00 per unit (in each case as adjusted for any stock dividends, combinations, splits, recapitalizations and the like with respect to shares of common stock effectuated after August 15, 2018), in each case in the initial closing of the such offering, and (ii) resulting in at least \$15,000,000 in gross proceeds to the company (prior to the deduction of underwriting discounts and registration expenses), in a firm-commitment underwritten public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended. The Conversion Price was initially \$1.3995 for each share of Series A, B and B-1 convertible preferred stock, \$1.4043 for each share of Series C convertible preferred stock and \$0.48 for each share of Series D and D-1 convertible preferred stock. The Conversion Price is subject to adjustment in certain circumstances.

*Dividends*

Holders of the Series Preferred are entitled to receive cash dividends at the rate of 8% of the applicable Original Issue Price (as defined below) per annum, on a non-cumulative basis, on each outstanding share of Series Preferred. The Company shall not declare any dividends on any shares of Series Preferred other than shares of Series D-1 convertible preferred stock unless the holders of the Series D-1 convertible preferred stock then outstanding first receive, or simultaneously receive, full payment of a dividend. The Original Issue Price is \$2.733 per share for the Series A convertible preferred stock, \$1.3995 per share for the Series B convertible preferred stock, \$1.3995 per share for the Series B-1 convertible preferred stock, \$1.4043 per share for the Series C convertible preferred stock, \$0.48 per share for the Series D convertible preferred stock and \$0.48 per share for the Series D-1 convertible preferred stock, each subject to adjustment in the event of any reorganization, stock split, recapitalization or other similar event involving or affecting a change in the Company's capital structure.

*Liquidation Preferences*

In the event of liquidation or winding up of the Company, (i) the holders of the Series D and D-1 convertible preferred stock, on a pari passu basis, shall be entitled to receive, prior to and in preference to any payment or distribution to the holders of, Series C convertible preferred stock, Series B and B-1 convertible preferred stock, Series A convertible preferred stock and common stock, a per-share amount equal to the applicable Liquidation Preference (as defined below); (ii) the holders of the Series C convertible preferred stock, on a pari passu basis, shall be entitled to receive, prior to and in preference to any payment or distribution to the holders of Series B and B-1 convertible preferred stock, Series A convertible preferred stock, and common stock, a per-share amount equal to the applicable Liquidation Preference; and (iii) the holders of Series B and B-1 convertible preferred stock and the holders of Series A convertible preferred stock, on a pari passu basis, shall be entitled to receive, prior to and in preference to any payment or distribution to the holders of common stock, a per-share amount equal to the applicable Liquidation Preference. The Liquidation Preference is calculated as follows: (i) when the Company is valued at \$91 million or below, the Liquidation Preference is equal to the applicable Original Issue Price for such shares plus the amount of any declared but unpaid dividends and (ii) when the company is valued greater than \$91 million, the Liquidation Preference is equal to the applicable Original Issue Price for such shares plus the amount of any declared but unpaid dividends, with the first \$10 million of proceeds above \$91 million distributed to the holders of the Series D and D-1 convertible preferred stock on a pro rata basis ((i) and (ii) together, "Liquidation Preference").

The authorized shares, purchase price, outstanding shares and Liquidation Preference for each series of convertible preferred stock as of December 31, 2017 and June 30, 2018 (unaudited), are as follows:

	Shares Authorized (December 31, 2017)	Shares Authorized (June 30, 2018)	Purchase Price Per Share	Shares Outstanding	Liquidation Preference
Convertible preferred stock:					
Series A	418,767	418,767	\$ 1.39950	345,587	\$ 483,649
Series B	8,101,042	8,101,042	\$ 1.39950	8,058,170	\$ 11,277,409
Series B-1	7,523,734	7,523,734	\$ 1.39950	3,437,950	\$ 4,811,411
Series C	23,357,047	23,357,047	\$ 1.40430	23,357,047	\$ 32,800,301
Series D	52,835,720	52,835,720	\$ 0.48000	20,652,486	\$ 9,913,193
Series D-1	125,808,667	126,746,167	\$ 0.48000	66,141,257	\$ 31,747,803
Total	<u>218,044,977</u>	<u>218,982,477</u>		<u>121,992,497</u>	<u>\$ 91,033,766</u>

**Series A, B and C Convertible Preferred Stock Modification**

On March 6, 2016 (the "Series A-C Modification Date"), the Company notified existing holders of Series A, B, B-1 and C convertible preferred stock that they would be required to participate in the Series D convertible

preferred stock financing at a specified pro rata amount (which equated to their existing applicable ownership percentage of the company).

As of the Series A-C Modification Date, the conversion ratio of Series A, B, B-1 and C convertible preferred stock was adjusted from 1:1 to 1:10 (i.e., 1 share of convertible preferred stock was convertible to 10 shares of common stock) for holders of the Series A, B, B-1 and C convertible preferred stock that elected to participate in the second issuance of the Series D convertible preferred stock financing at or above their pro rata amounts. If the holders of Series A, B, B-1 and C convertible preferred stock did not participate at or above their pro rata amounts, any existing shares of Series A, B, B-1 and C convertible preferred stock were automatically and mandatorily converted into common stock on a 1:1 basis (which represented the existing conversion ratio in effect prior to such modification). Such an automatic conversion would result in the loss of all rights and privileges associated with being a holder of convertible preferred stock (i.e. liquidation preference, board representation and dividend rights).

If the holders of Series A, B, B-1 and C convertible preferred stock elected to participate in the Series D convertible preferred stock financing in excess of their pro rata amount, any additional investment would result in the issuance of warrants to purchase Series D convertible preferred stock. The effective price of the warrants to purchase Series D convertible preferred stock at the date of issuance was a 15% discount from the selling price of the Series D convertible preferred stock.

The Company follows the qualitative approach to assessing changes in terms of convertible preferred stock. Based on its qualitative assessment, the Company determined that the revision of the terms of the Series A, B, B-1 and C convertible preferred stock resulted in both the extinguishment of the Series A, B, B-1 and C convertible preferred stock and the reissuance of the Series A, B, B-1 and C convertible preferred stock. Accordingly, the Company concluded that the difference between the fair value of the post-modification Series A, B, B-1 and C convertible preferred stock and the carrying value of the pre-modification Series A, B, B-1 and C convertible preferred stock should be recognized as an adjustment recorded through accumulated deficit.

The impact of the special mandatory conversion of convertible preferred stock to common stock, as well as the fair value adjustment is as follows:

	Pre-Modification		Post Modification	
	Book Value	Outstanding Shares	Fair Value	Outstanding Shares
Series A preferred stock	\$ 4,989,018	1,908,757	\$ 61,847	345,587
Series B preferred stock	23,909,095	17,195,333	842,845	8,058,170
Series B-1 preferred stock	10,359,042	7,441,559	359,593	3,437,950
Series C preferred stock	48,930,547	37,752,481	5,547,841	23,357,047
	<u>\$ 88,187,702</u>	<u>64,298,130</u>	<u>\$ 6,812,126</u>	<u>35,198,754</u>

On August 4, 2016, in connection with the Reverse Stock Split (as defined below), the conversion ratio of the existing Series A, B, B-1 and C convertible preferred stock was adjusted back to 1:1 (i.e., 1 share of convertible preferred stock was convertible to 1 share of common stock).

**Warrants**

On July 3, 2012, in conjunction with the Square 1 LSA, the Company issued a warrant to purchase 64,309 shares of Series B-1 convertible preferred stock to Square 1 Bank at an exercise price of \$1.3995 per-share. The warrant expires in July 2019.

On December 11, 2013, in conjunction with an amendment to the Square 1 LSA, the Company issued a warrant to purchase 10,718 shares of Series B-1 convertible preferred stock to Square 1 Bank at an exercise price of \$1.3995 per-share. The warrant expires in December 2020.

On September 17, 2013, in conjunction with the subordinated convertible promissory notes that were issued in connection with the September 2013 Note and Warrant Purchase Agreement, the Company issued warrants to purchase 1,480,988 shares of Series B-1 convertible preferred stock. Per the terms of the September 2013 Note and Warrant Purchase Agreement, the number of shares of Series B-1 convertible preferred stock purchasable under these warrants was increased to 2,123,528 shares as the Company did not complete a qualified financing prior to January 1, 2014. The warrants allow the investors to purchase Series B-1 convertible preferred stock at an exercise price of \$1.3995 per-share. The warrants expire in 2023.

On June 12, 2014, in conjunction with the subordinated convertible promissory notes that were issued in connection with the June 2014 Note and Warrant Purchase Agreement, the Company issued warrants to purchase 715,766 shares of Series B-1 convertible preferred stock at an exercise price of \$1.3995 per-share. The warrants expire in 2024.

On September 9, 2014 and November 11, 2014, in conjunction with the issuance of Series C convertible preferred stock, the Company issued warrants to purchase 4,450,616 shares and 6,527,568 shares of Series C convertible preferred stock, respectively, at an exercise price of \$1.4043 per-share. On March 31, 2016, all warrants to purchase Series C convertible preferred stock issued in conjunction with the Series C convertible preferred stock offering expired under the terms of their issue with no investor electing to exercise their warrants. As such, these warrants have been retired by the Company.

On March 4, 2016, in conjunction with the Series D convertible preferred stock offering, the Company issued warrants to purchase 31,672,817 shares of Series D convertible preferred stock at an exercise price of \$0.41 per-share. The warrants expire in 2026.

On March 8, 2016, in conjunction with the Western Alliance LSA, the Company issued a warrant to purchase 510,417 shares of Series D convertible preferred stock to Western Alliance Bank at an exercise price of \$0.48 per-share. Additionally, in conjunction with the first amendment to the Western Alliance LSA, on December 9 2016, the Company issued a warrant to purchase 291,667 shares of Series D-1 convertible preferred stock to Western Alliance Bank at an exercise price of \$0.48 per-share. Both of these warrants expire in 2026.

On June 29, 2018, in conjunction with the MidCap Financial CSA, the Company issued a warrant to purchase 625,000 shares of Series D-1 convertible preferred stock to MidCap Financial at an exercise price of \$0.48 per-share. This warrant expires in 2028.

All the outstanding warrants to purchase convertible preferred stock are classified as liabilities in the financial statements and are valued at each reporting period using the Black-Scholes-Merton model as discussed in Note 3, "Fair Value Measurements".

#### **Common Stock**

On August 4, 2016, the Company filed a Certificate of Amendment of the Company's Certificate of Incorporation with the Secretary of State of the State of Delaware to effect a reverse split of common stock at a ratio of one-for-ten, which became effective at the close of business on that day (the "Reverse Stock Split"). As a result, each share of the Company's common stock outstanding as of August 4, 2016 was automatically changed into one-tenth of a share of common stock, which resulted in a reduction of 1,411,180 shares of common stock issued and outstanding. No fractional shares were issued in connection with the Reverse Stock Split and cash paid to stockholders for potential fractional shares was insignificant. The authorized number of shares and the par value per share of the Company's common stock were not affected by the Reverse Stock Split.

During 2016, the Company issued 338 shares of common stock in connection with the exercise of stock options, for net proceeds of \$1,961.

During 2017, the Company issued 7,079 shares of common stock in connection with the exercise of stock options, for net proceeds of \$14,265.

During the six months ended June 30, 2018, the Company issued 788 shares of common stock in connection with the exercise of stock options, for net proceeds of \$1,012.

**Stock Options**

The Company's Amended and Restated 2006 Equity Compensation Plan, as amended (the "Plan"), is to provide designated employees of the Company, its subsidiaries, consultants, advisors and non-employee members of the Board with the opportunity to receive grants of incentive stock options and nonqualified stock options. The Company believes that the Plan will encourage the participants to contribute materially to the growth of the Company, thereby benefiting the Company's stockholders, and will align the economic interests of the participants with those of the stockholders. As of December 31, 2016, and 2017, and June 30, 2018, the number of shares reserved under the Plan was 511,194.

There were 464,803, 57,904 and 83,597 shares available for grant under the Plan as of December 31, 2016 and 2017, and June 30, 2018, respectively. Options granted under the Plan are exercisable at various dates as determined upon grant and will expire no more than ten years from the date of grant, or in the case of certain non-statutory options, exactly ten years from the date of grant. The exercise price of each option shall be determined by the Board of Directors although generally options have an exercise price equal to the fair market value of the Company's stock on the date of the option grant. In the case of incentive stock options, the exercise price shall not be less than 100% of the fair market value of the Company's common stock at the time the option is granted. For holders of more than 10% of the Company's total combined voting power of all classes of stock, incentive stock options may not be granted at less than 110% of the fair market value of the Company's stock at the date of grant and for a term not to exceed five years. Most option grants generally vest 25% on the first anniversary of the original vesting commencement date, with the balance vesting monthly in equal installments over the remaining three years.

A summary of the Company's stock option activity under the Plan is as follows:

	Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Term	Aggregate Intrinsic Value
Outstanding at December 31, 2016	43,596	\$ 42.80	8.0	\$ —
Granted	461,978	1.28		—
Exercised	(7,077)	2.14		\$ 80,959
Cancelled	(62,156)	3.42		—
Outstanding at December 31, 2017	436,341	\$ 5.14	9.0	\$ —
Granted (unaudited)	385	1.28		—
Exercised (unaudited)	(788)	1.28		\$ 1,012
Cancelled/Expired (unaudited)	(19,001)	6.44		—
Outstanding at June 30, 2018 (unaudited)	416,937	\$ 4.99	8.5	\$ —
Vested and expected to vest at December 31, 2016	39,003	\$ 46.22	7.5	\$ —
Vested and exercisable at December 31, 2016	19,421	\$ 62.92	5.9	\$ —
Vested and expected to vest at December 31, 2017	460,458	\$ 5.56	9.0	\$ —
Vested and exercisable at December 31, 2017	193,425	\$ 8.56	8.8	\$ —
Vested and expected to vest at June 30, 2018 (unaudited)	395,986	\$ 3.27	8.5	\$ —
Vested and exercisable at June 30, 2018 (unaudited)	237,804	\$ 7.17	8.5	\$ —



For the six months ended June 30, 2018, the Company granted to its employee's options to purchase 385 shares of its common stock with an exercise price of \$1.28 per share.

From February through May 2017, the Company granted to its employee's options to purchase 404,937 shares of its common stock with an exercise price of \$1.28 per share.

For the years ended December 31, 2016 and 2017, the total grant date fair value of vested options was \$246,378 and \$365,154, respectively. The weighted-average grant date fair value of employee option grants during the years ended December 31, 2016 and 2017 was \$1.28.

For the six months ended June 30, 2017 and 2018, the total grant date fair value of vested options was \$169,021 and \$111,942, respectively. The weighted-average grant date fair value of employee option grants during the six months ended June 30, 2017 and 2018 was \$1.28.

**Stock-Based Compensation Expense**

The Company recognized stock-based compensation expense of \$130,643, \$382,830, \$217,846 and \$107,426 for the years ended December 31, 2016 and 2017 and the six months ended June 30, 2017 and 2018, respectively.

The weighted-average assumptions used in the Black-Scholes option pricing model to determine the fair value of the employee stock option grants were as follows:

	Year Ended December 31,		Six months ended	
	2016	2017	2017	2018
Risk-free interest rate	1.1 - 1.4%	1.8 - 2.0%	1.9%	2.5%
Expected volatility	77 - 83%	58 - 67%	59%	63%
Expected term (in years)	5.3 - 5.4	5.1 - 5.3	5.1	4.0
Expected dividend yield	0%	0%	0%	0%

*Risk-free interest rate.* The risk-free rate assumption is based on the U.S. Treasury instruments, the terms of which were consistent with the expected term of the Company's stock options.

*Expected volatility.* Due to the Company's limited operating history and lack of company-specific historical or implied volatility as a private company, the expected volatility assumption was determined by examining the historical volatilities of a group of industry peers whose share prices are publicly available.

*Expected term.* The expected term of stock options represents the weighted-average period the stock options are expected to be outstanding. The Company uses the simplified method for estimating the expected term as provided by the Securities and Exchange Commission. The simplified method calculates the expected term as the average of the time-to-vesting and the contractual life of the options.

*Expected dividend yield.* The expected dividend assumption is based on the Company's history and expectation of dividend payouts. The Company has not paid and does not intend to pay dividends.

*Forfeitures.* The Company reduces stock-based compensation expense for actual forfeitures during the period.

As of December 31, 2016 and 2017 and June 30, 2018, the unrecognized compensation cost related to outstanding employee options was \$393,213, \$282,642 and \$179,526, respectively, and is expected to be recognized as expense over approximately 2.6 years, 1.6 years and 1.2 years, respectively.

**Common Stock Reserved for Future Issuance**

Common stock reserved for future issuance consist of the following:

	Year Ended December 31,		Six Months
	2016	2017	Ended June 30, 2018 (unaudited)
Convertible preferred stock	1,986,377	2,850,276	2,850,280
Stock options issued and outstanding	43,596	436,341	416,937
Authorized for future stock awards or option grants	464,803	57,904	83,597
Preferred warrants	856,921	855,212	869,814
Total	<u>3,351,697</u>	<u>4,199,733</u>	<u>4,220,628</u>

**9. Commitments and Contingencies****Leases**

The Company leases certain office and lab space in San Diego, California under a non-cancelable operating lease, which was amended July 1, 2015 to add laboratory space and office space and extend its terms through December 2020. Rent expense was \$495,475, \$590,089, \$295,044, and \$295,044 for the years ended December 31, 2016 and 2017 and six months ended June 30, 2017 and 2018, respectively, including the offset for amortization of the leasehold incentive obligation of \$150,035, \$225,052, \$112,526 and \$112,526 for the years ended December 31, 2016 and 2017 and the six months ended June 30, 2017 and 2018, respectively.

The future minimum lease payments required under non-cancelable leases as of December 31, 2017, are summarized as follows:

Year Ending December 31,	
2018	\$ 826,884
2019	862,656
2020	902,412
Total minimum lease payments	<u>\$ 2,591,952</u>

**Royalty Agreements**

The Company has entered into agreements to market and distribute chips and kits used in its instruments. Pursuant to these agreements, the Company is obligated to pay royalties based on sales during each annual license period and is obligated to make minimum payments regardless of the level of sales achieved. The Company has paid \$221,688, \$233,128, \$116,466 and \$166,483 for the years ended December 31, 2016 and 2017 and the six months ended June 30, 2017 and 2018, respectively.

Such royalty agreements extend through the life of underlying intellectual property which is affected by patent filing date and jurisdiction. As of December 31, 2017, annual future minimum royalty payments under the Company's royalty agreements total \$70,000, on a continuing basis, and extend through November 29, 2026.

**Purchase Commitments**

The Company has a contractual commitment with a supplier to purchase \$100,000 of products each quarter until the first quarter of 2019. The Company is not able to determine the aggregate amount of other such purchase orders that represent contractual obligations, as purchase orders may represent authorizations to

purchase rather than binding agreements. The Company's purchase orders are based on its current procurement or development needs and are fulfilled by the Company's vendors within short time horizons.

**Litigation**

The Company is subject to potential liabilities under various claims and legal actions that are pending or may be asserted. These matters arise in the ordinary course and conduct of the business. The Company intends to continue to defend itself vigorously in such matters. The Company regularly assesses contingencies to determine the degree of probability and range of possible loss for potential accrual in the financial statements. An estimated loss contingency is accrued in the financial statements if it is probable that a liability has been incurred and the amount of the loss can be reasonably estimated. Based on the Company's assessment, it currently does not have any amount accrued as it is not a defendant in any claims or legal actions.

**10. Income Taxes**

	December 31,	
	2016	2017
Deferred tax assets:		
Net operating loss carryforwards	\$ 39,333,135	\$ 30,528,420
Research and development credits	3,057,595	4,078,522
Other	884,910	1,163,659
Total gross	43,275,640	35,770,601
Valuation allowance	(43,275,640)	(35,770,601)
Net deferred tax assets	\$ —	\$ —

The provision for domestic and foreign income taxes is as follows:

	Years Ended December 31,	
	2016	2017
Current:		
Foreign	\$ 12,060	\$ 16,996
State and local	864	1,556
Income tax provision	\$ 12,924	\$ 18,552

The domestic and foreign components of income (loss) from continuing operations are as follows:

	Years Ended December 31,	
	2016	2017
Domestic	\$(18,892,417)	\$(23,455,215)
Foreign	56,726	108,403
Loss before provision for income taxes	\$(18,835,691)	\$(23,346,812)

A reconciliation of the income tax computed at the federal statutory tax rate to the expense for income taxes for the years ended December 31, 2016 and 2017 is as follows:

	December 31,	
	2016	2017
Tax at statutory rate	\$(6,404,287)	\$ (7,939,075)
State income taxes, net of federal benefits	(195,417)	(376,232)
Change in valuation allowance	7,278,255	(7,523,665)
Tax Cuts and Jobs Act	—	16,552,989
Other permanent differences	394,784	542,487
Credits	(1,060,411)	(1,237,952)
Income tax expense	<u>\$ 12,924</u>	<u>\$ 18,552</u>

On December 22, 2017, the President of the United States signed into law the Tax Cuts and Jobs Act (the “Act”). The Act amends the Internal Revenue Code to reduce tax rates and modify policies, credits, and deductions for individuals and businesses. For businesses, the Act reduces the corporate tax rate from a maximum of 35% to a flat 21% rate. The rate reduction is effective on January 1, 2018. The Company has calculated its best estimate of the impact of the Act and as a result of the rate reduction, the Company has recorded a reduction to the deferred tax asset balance as of December 31, 2017 by \$16.6 million, offset by a full valuation allowance. The Company has reduced its valuation allowance by \$7.5 million due to the full valuation allowance position. The reduction in the valuation allowance includes the revaluation of the deferred tax assets, current year losses, and other timing items.

On December 22, 2017, Staff Accounting Bulletin No. 118 (“SAB 118”) was issued to address the application of GAAP in situations when a registrant does not have the necessary information available, prepared, or analyzed (including computations) in reasonable detail to complete the accounting for certain income tax effects of the Act. In accordance with SAB 118, the Company’s provisional determination is that there is no deferred tax benefit or expense with respect to the remeasurement of certain deferred tax assets and liabilities due to the full valuation allowance against net deferred tax assets. Additional analysis of the law and the impact to the Company will be performed and any impact will be recorded in the respective quarter in 2018. The Company did not record any adjustments to this provisional amount during the six months ended June 30, 2018 and will continue to analyze and refine its calculations related to the remeasurement as the impact of the Act is finalized.

As of December 31, 2017, the Company has federal and state tax net operating loss carryforwards of \$128.3 million and \$51.0 million, respectively. The federal and state tax loss carryforwards begin to expire in 2027 and 2031, respectively, unless previously utilized. The Company also has federal and California research credit carryforwards of \$4.0 million and \$3.6 million, respectively. The federal research credit carryforwards and state credit carryforwards begin to expire in 2027 unless previously utilized. The California research credits carry forward indefinitely.

Management assesses all available evidence to estimate if sufficient future taxable income will be generated to use the existing deferred tax assets. The Company has experienced net losses since inception, and the revenue and income potential of the Company’s business and market are unproven. Due to the Company’s continuing research and development activities, the Company expects to continue to incur net losses into the foreseeable future. As such, the Company cannot conclude that it is more likely than not that its deferred tax assets will be realized. A valuation allowance of \$43.3 million and \$35.8 million as of December 31, 2016 and 2017, respectively, has been established to offset the deferred tax assets, as realization of such assets is uncertain.

Utilization of the net operating losses and research and development (“R&D”) credit carryforwards are subject to annual limitations due to ownership change limitations that have occurred or that could occur in the future, as required by Section 382 of the Internal Revenue Code of 1986, as amended (the “Code”), as well as

similar state and foreign provisions. These ownership changes may limit the amount of net operating losses and R&D credit carryforwards that can be utilized annually to offset future taxable income and tax, respectively. In general, an “ownership change” as defined by Section 382 of the Code results from a transaction or series of transactions over a three-year period resulting in an ownership change of more than 50 percentage points of the outstanding stock of a company by certain stockholders.

During 2013, the Company completed a Section 382/383 analysis, from inception through December 31, 2012, regarding the limitation of the net operating losses and R&D credits. Based upon the analysis, the Company determined that no ownership changes occurred during that period. However, there may have been ownership changes subsequent to December 31, 2012, that could limit the Company’s ability to utilize the net operating loss and R&D credit carryforwards. The Company plans to complete an analysis prior to using any of the net operating losses and R&D credits.

The Company is subject to taxation in the United States and the United Kingdom. The Company’s tax years from 2007 (inception) are subject to examination by the United States and state authorities due to the carry forward of unutilized net operating losses and R&D credits.

A reconciliation of the beginning and ending amount of unrecognized tax benefits for 2016 and 2017, excluding interest and penalties, is as follows:

	December 31,	
	2016	2017
Balance at beginning of the year	\$ 1,903,164	\$ 2,451,121
Additions/(reductions) for tax positions - prior year	34,365	—
Increase related to prior year positions - current year	513,592	567,442
Increase related to current year positions	—	—
Balance at the end of the year	<u>\$ 2,451,121</u>	<u>\$ 3,018,563</u>

The Company recognizes the impact of uncertain tax positions at the largest amount that is “more likely than not” to be sustained upon audit by the relevant taxing authority. An uncertain tax position will not be recognized if it has less than a 50% likelihood of being sustained. Due to the valuation allowance position, none of the unrecognized tax benefits, if recognized, will impact the Company’s effective tax rate. The Company does not anticipate a significant change in the unrecognized tax benefits during the next twelve months.

#### 11. Employee Benefits

The Company has a defined contribution 401(k) plan available to eligible employees. Under the terms of the plan, employees may make voluntary contributions as a percent of compensation, limited to the maximum amount allowable under federal tax regulations. The Company, at its discretion, may make certain contributions to the 401(k) plan. The Company made matching contributions of \$408,675 and \$395,360, and, \$237,574 and \$133,165, for the years ended December 31, 2016 and 2017 and the six months ended June 30, 2017 and 2018, respectively.

#### 12. Subsequent Events

For the purposes of the financial statements as of December 31, 2017 and the year then ended, the Company identified subsequent events through May 11, 2018, the date on which the financial statements were issued, and, with respect to the reverse stock split transactions described below, through July 16, 2018 and August 15, 2018.

For the purposes of the financial statements as of June 30, 2018 and the six months then ended, the Company has evaluated subsequent events through July 13, 2018, the date on which the financial statements were issued, and, with respect to the reverse stock split transactions described below, through July 16, 2018 and August 15, 2018.

***Reverse Stock Splits***

On July 16, 2018, the Company effected a one-for-21.4 reverse stock split of its issued and outstanding shares of common stock and a proportional adjustment to the existing conversion ratios for each series of the Company's redeemable convertible preferred stock, and on August 15, 2018, the Company effected an additional one-for-2 reverse stock split of its issued and outstanding shares of common stock and a proportional adjustment to the existing conversion ratios for each series of the Company's redeemable convertible preferred stock (see Note 8). Accordingly, all share and per share amounts for all periods presented in the accompanying financial statements and notes thereto have been adjusted retroactively, where applicable, to reflect these reverse stock splits and adjustments of the preferred stock conversion ratios.

3,360,000 Units

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*Sole Book-Running Manager*

**Roth Capital Partners**

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*Lead Manager*

**Maxim Group LLC**

*Co-Manager*

**LifeSci Capital LLC**

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Through and including September 15, 2018 (the 25th day after the date of this prospectus), all dealers that effect 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.

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