FLUIDIGM®

2019 ANNUAL REPORT and 2020 PROXY STATEMENT

FLUIDIGM®

May 14, 2020

Dear fellow stockholders,

As I write this letter in the spring of 2020, we find ourselves in a starkly different world from the one we knew a few short months ago. It is one of extraordinary challenge, but also great opportunity.

Our products, technologies, and expertise enable important research on multiple frontiers of human health, and they are now being brought to bear by the global scientific community in the fight against the unprecedented COVID-19 pandemic.

A growing number of government and medical institutions that are addressing the pandemic are engaging with Fluidigm from the perspectives of both immune profiling and virus detection and testing. Like so many in the life science community, we are engaged with and providing support to our customers in every way we can to make meaningful inroads in the fight against COVID-19.

Given the powerful capabilities of our two technology platforms, mass cytometry and microfluidics, it is no surprise that we are at the forefront of this unparalleled global effort. However, the company is also remarkably well-equipped to make meaningful contributions to life science research for the long term.

Our fundamental value proposition is unchanged. A defining trend of this decade will be discovery of new biomarkers for disease insight and treatment—in immunology, immune function, immuno-oncology, and infectious disease.

Our innovative technology powering biomarker discovery and deployment puts us in the right place at the right time, focused on the right opportunities.

For the year 2019, we drove innovation, launching more than 10 new products for our mass cytometry business. Fluidigm received the Life Science Industry Award for Best New Product in Cell Biology for our Maxpar® Direct™ Immune Profiling System.

Our mass cytometry business made impressive progress on many fronts:

- We drove mass cytometry utilization with 2019 revenue growth of 23%, powered by strong sales of our imaging system configuration.
- We increased our active installed base of mass cytometry units to 292, with 85 enabled for imaging.
- Important publications based on mass cytometry exceeded 1,000, documenting meaningful findings across immunology, immune function, immuno-oncology, and infectious disease. In early 2020, a landmark study in breast cancer utilizing Imaging Mass Cytometry™ exemplified our momentum toward further adoption of IMC™ in translational and clinical research.
- Our mass cytometry technology powered 75 clinical trials as of year-end. We believe our involvement in translational studies on a substantial scale is only beginning.

- We signed new partnerships and collaboration agreements to supplement our organic initiatives, including a significant development program funded by the U.S. Defense Department's Defense Advanced Research Projects Agency (DARPA) and the establishment of a new Center of Excellence for Imaging Mass Cytometry in Singapore, a joint effort with the Singapore Immunology Network, part of the Agency for Science, Technology and Research. Momentum continued into early 2020 with our acquisition of InstruNor AS, the privately held provider of the only fully integrated sample preparation system for flow and mass cytometry.

In the second half of 2019, we embarked on an effort to expand our commercial footprint in order to return microfluidics to growth. Our strategy included enhanced specialist sales coverage for each franchise. We also secured new collaborations and partnerships and pursued more opportunities to further increase share of wallet. We focused on commercializing improved workflows, improving channel reach, and identifying novel content for disease, diagnosis, and treatment.

At the corporate level, we made enormous strides in improving our balance sheet, eliminating $150 million of debt in the first quarter of 2019 and refinancing the remainder of our 2014 convertible notes in the fourth quarter.

We strengthened our Board of Directors with the addition of Bill W. Colston, who brings extensive experience across a range of innovative life science and technology ventures.

For the executive leadership team, we welcomed Colin McCracken as Chief Commercial Officer, charged with driving revenue growth in new and existing markets and expanding the company's global reach. Andrew Quong, PhD, became our Chief Science Officer, leading our strategy for the generation of bold scientific insights in immunology, immuno-oncology, and other frontiers of human health based on our technology.

Finally, in an affirmation of the culture we are building across the company, Fluidigm was named one of Greater Toronto's Top Employers for 2020, an annual list of organizations with exceptionally positive and engaging environments that inspire and motivate employees.

Fluidigm made solid progress in 2019, enabling us to begin 2020 with an improved balance sheet, a renewed commitment to innovation and revenue growth, engaged and motivated leadership, and a focus on financial discipline and operational improvements.

We are committed to driving sustained growth and long-term value creation. I have never been more confident about the long-term success of Fluidigm, supported by the hard work, commitment, ideas, and energy of our 500 employees around the world.

Onward and upward.

S Christopher Linthwaite

Christopher Linthwaite
President and Chief Executive Officer

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

FORM 10-K

(Mark One)

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

For the fiscal year ended December 31, 2019

or

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

Commission file number: 001-34180

FLUIDIGM CORPORATION

(Exact name of registrant as specified in its charter)

Delaware	**77-0513190**
State or other jurisdiction of incorporation or organization	I.R.S. Employer Identification No.
2 Tower Place, Suite 2000 South San Francisco, CA	**94080**
Address of principal executive offices	Zip Code

Registrant's telephone number, including area code: **(650) 266-6000**

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, $0.001 par value per share	**FLDM**	**The Nasdaq Global Select Market**

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

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

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

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

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

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

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

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

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

As of June 30, 2019, the aggregate market value of the voting and non-voting common equity held by non-affiliates of the registrant was approximately $846,923,899, based on the closing sale price on that date. Shares of common stock held by each executive officer and director and by each other person who may be deemed to be an affiliate of the Registrant have been excluded from this computation. The determination of affiliate status for this purpose is not necessarily a conclusive determination for other purposes.

As of January 31, 2020, there were 70,706,062 shares of the registrant's common stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's Proxy Statement in connection with the registrant's annual meeting of stockholders, scheduled to be held in June 2020, are incorporated by reference in Part III of this report. Except as expressly incorporated by reference, the registrant's Proxy Statement shall not be deemed to be part of this report.

Fluidigm Corporation

Fiscal Year 2019
Form 10-K
Annual Report

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Special Note Regarding Forward-looking Statements and Industry Data

This Annual Report on Form 10-K (Form 10-K) contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, or Securities Act, and Section 21E of the Securities Exchange Act of 1934, as amended, or Exchange Act, that are based on our management's beliefs and assumptions and on information currently available to our management. The forward-looking statements are contained principally in the sections entitled "Business," "Risk factors," and "Management's discussion and analysis of financial condition and results of operations." Forward-looking statements include information concerning our possible or assumed future cash flow, revenue, sources of revenue and results of operations, cost of product revenue and product margin, operating and other expenses, unit sales and the selling prices of our products, business strategies, financing plans, expansion of our business, competitive position, industry environment, potential growth opportunities, market growth expectations, and the effects of competition. Forward-looking statements include statements that are not historical facts and can be identified by terms such as "anticipates," "believes," "could," "seeks," "estimates," "expects," "intends," "may," "plans," "potential," "predicts, "projects," "should," "will," "would," or similar expressions and the negatives of those terms.

Forward-looking statements involve known and unknown risks, uncertainties, and other factors that may cause our actual results, performance, or achievements to be materially different from any future results, performance, or achievements expressed or implied by the forward-looking statements. We discuss these risks in greater detail in the section entitled "Risk factors" and elsewhere in this Form 10-K. Given these uncertainties, you should not place undue reliance on these forward-looking statements.

Forward-looking statements represent our management's beliefs and assumptions only as of the date of this Form 10-K. Except as required by law, we assume no obligation to update these forward-looking statements, or to update the reasons actual results could differ materially from those anticipated in these forward-looking statements, even if new information becomes available in the future. You should read this Form 10-K completely and with the understanding that our actual future results may be materially different from what we expect.

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

Fluidigm®, the Fluidigm logo, 48.Atlas™, Acculift™, Access Array™, Advanta™, Biomark™, Bringing new insights to life™, C1™, Callisto™, Cell-ID™, CyTOF®, D3™, Delta Gene™, Direct™, Digital Array™, Dynamic Array™, EP1™, EQ™, FC1™, Flex Six™, Helios™, High-Precision 96.96 Genotyping™, Hyperion™, IMC™, Imaging Mass Cytometry™, Immune Profiling Assay™, Juno™, Maxpar®, MCD™, MSL®, Nanoflex™, Open App™, Pathsetter™, Polaris™, qdPCR 37K™, Script Builder™, Script Hub™, Singular™, SNP Trace™, SNP Type™ are trademarks or registered trademarks of Fluidigm Corporation. Other service marks, trademarks and trade names referred to in this Form 10-K are the property of their respective owners.

Unless the context requires otherwise, references in this Annual Report on Form 10-K to "Fluidigm," the "Company," "we," "us," and "our" refer to Fluidigm Corporation and its subsidiaries.

PART I

ITEM 1. BUSINESS

Overview

Fluidigm is a global company that improves life through comprehensive health insight. Our innovative patented technologies and multi-omic tools are used by researchers to reveal meaningful insights into health and disease, identify biomarkers to inform decisions, and accelerate the development of more effective therapies. We create, manufacture, and market a range of products and services, including instruments, reagents and software that are used by researchers worldwide.

Our focus is on the most pressing needs in translational and clinical research, including cancer, immunology and immunotherapy. We use proprietary CyTOF® and microfluidics technologies to develop innovative end-to-end solutions that have the flexibility required to meet the needs of translational research and the robustness to support high-impact clinical research studies.

Our mass cytometry Helios™ system deeply profiles cell phenotype and function. Referenced by hundreds of peer-reviewed publications around the world, mass cytometry is setting a new standard in human immune profiling. Transforming biological imaging, our Hyperion™ Imaging System enables highly multiplexed protein biomarker detection in tissues and tumors while still preserving tissue architecture and cellular morphology information using Imaging Mass Cytometry™ (IMC™). Our microfluidic systems complement our mass cytometry offerings by providing highly scalable and automated workflows for quantitative polymerase chain reaction (PCR), gene expression, copy number variation analysis, and next-generation sequencing library preparation. Used to detect somatic and genomic variations from a range of different sample types, these automated systems provide the cost efficiencies, flexibility and proven analytical performance that customers need to meet the increasing demands of molecular biomarker analysis.

We are a trusted partner of leading academic, government, pharmaceutical, biotechnology, contract research organizations and plant and animal research laboratories worldwide and we strive to increase the quality of life for all.

Market Opportunity

We believe that the Immunome market is a large, under-penetrated multibillion dollar market opportunity. Through our work with outside consultants and internal market analysis, we believe that our potential market is approximately $3 billion, growing at a compound annual growth rate in the teens. The current markets for our products address a broad range of biological analysis approaches, including the genome, proteome, transcriptome, epigenome and microbiome used by academic life science research customers, as well as applied markets customers, including clinical research laboratories, biopharmaceutical companies, biorepositories and agricultural biotechnology entities. Our markets are increasingly looking to study data sets spanning these approaches in a concerted manner to answer pressing questions about immune function across cancer, immunology and immunotherapy.

Strategy

Key elements of our strategy include:

Offering innovative, differentiated products to researchers based on our mass cytometry and microfluidic technologies.

- Mass cytometry is a leading, high multiplex solution to analyze many cell-surface and intracellular proteins simultaneously in cell suspensions including blood and disassociated tissues. Our products enable innovative methods to characterize cells and other sample types not commonly achieved with other conventional technologies.

- IMC™ is a pioneering technology allowing for high multiplexed imaging to understand the composition of tissue microenvironments at a subcellular 1-micron resolution. Together with Mass Cytometry, these products provide researchers the capabilities to gain deeper insights into immune function.

  Our microfluidic technologies enable a scalable and sensitive solution in fields requiring high-throughput molecular biomarker analysis, whether it be for the analysis of gene expression profiles, genotyping, analysis of proteomic biomarkers, or library preparation in advance of gene sequencing.

Expanding addressable markets through attention to assay content, workflow efficiency, software improvements, desirable strategic partnerships and inorganic growth opportunities.

Our strategy addresses expanded and enhanced applications, workflows and analytics to allow our customers better productivity, increasing the value of our toolsets across our mass cytometry and microfluidics products.

- We have developed a sample-to-answer workflow for comprehensive human immune profiling for use with our Helios system, that puts pre-titrated antibodies in dry format in a single tube, with automated software that provides data analysis in as few as five minutes. This assay is reproducible from site-to-site and lot-to-lot, which is important for translational and pharma/biotech research work. We have collaborated with industry partners to enable workflows and software for both the Helios and Hyperion systems. In 2019, we added seven new metal antibody labels, becoming the first company to enable 50-plex cytometry panels, launched three Imaging Mass Cytometry Panel Kits and Advanced CyTOF software, as well as Maxpar Direct Immune Profiling Assay, a sample-to-answer workflow that received the 2019 Life Science Industry Gold Award for Most Innovative New Cell Biology Product.

- We have developed and collaborated with industry partners to build our applications, software and assays on our microfluidic platforms for gene expression, genotyping and sequencing library preparations as well as single-cell applications for our C1 system. Our future development will leverage both in-house development as well as externally-partnered solutions to drive new applications and sample-to-answer functionality across all our platforms. In 2019, we launched the Advanta RNA-Seq NGS Library Preparation product targeting a large potential market opportunity, in line with this strategy. We also announced a collaboration with Icahn School of Medicine at Mount Sinai for a single-cell study of the human epigenome. This study is being funded by the U.S. Department of Defense.

Products

We market innovative technologies and life science tools, including preparatory and analytical instruments for Mass Cytometry, PCR, Library Prep, Single Cell Genomics, and consumables, including integrated fluidic circuits (IFCs), assays, and reagents. Our primary product offerings are summarized in the table below:

Product	Product Description	Applications
Mass Cytometry		
Analytical Systems:		
Helios™, a CyTOF system	The Helios mass cytometry system performs high-parameter single-cell analysis using antibodies conjugated to metal isotopes.	Mass Cytometry
Hyperion™ Imaging System	The Hyperion Imaging System brings together imaging capability with proven high-parameter CyTOF technology to enable the simultaneous detection of up to 37 protein markers in the spatial context of the tissue microenvironment.	Imaging Mass Cytometry
Hyperion™ Tissue Imager	The Hyperion Tissue Imager scans tissues at 1 micron resolution. It can be purchased as an upgrade for the Helios system to enable imaging capability, then referred to as Hyperion Imaging System.	Imaging Mass Cytometry

Assays and Reagents:

Maxpar® Reagents	Maxpar® reagents are included in multiple product lines addressing needs in functional and phenotypic profiling of single cells, as well as nucleic acid detection. The product lines include pre-conjugated antibodies, application-specific kits, and custom antibody labeling services.	Mass Cytometry and Imaging Mass Cytometry.
Maxpar Human Immune Monitoring Panel Kit and Workflow	The kit contains 29 pre-titrated antibodies designed and optimized for deep immune profiling of human peripheral blood mononuclear cells. Enables comprehensive identification and characterization of key immune cell populations. The workflow includes protocol and data analysis.	Mass Cytometry
Maxpar Direct Immune Profiling Assay	The assay enables comprehensive identification and characterization of 37 immune cell populations. With automated software and as little as five minutes of data analysis. The kit contains 30 pre-titrated antibodies provided in a dry single-tube format.	Mass Cytometry
Maxpar IMC Panel Kits for Immuno-oncology	Contains a mix of non-overlapping metal-conjugated antibodies to deeply profile tumor-infiltrating lymphocytes, immunce cell activation states or tissue architecture. These new panels can be easily mixed and matched or combined as an 18-marker panel to broadly profile immune infiltrates.	Mass Cytometry

Software:

Advanced CyTOF Software 7.0	Streamlines the selection and acquisition of multiple regions of interest from each slide with an enhanced user experience. Remotely annotate each ROI using bright field reference images to guide automated batch acquisition of highly multiplexed images on the Hyperion Imaging System.	Mass Cytometry

Microfluidics

Preparatory Instruments:

Access Array System	A modular, flexible system that automates amplicon-based library preparation of up to 480 amplicons across 48 unique samples per processing run. The resulting barcoded libraries are ready for targeted DNA sequencing on next-generation sequencing (NGS) platforms from Illumina® and Ion Torrent®.	Library preparation for targeted DNA sequencing on NGS systems
Juno System	An integrated system that automates the preparation of amplicon-based libraries for targeted next-generation DNA sequencing. Additionally, Juno automates microfluidic workflows for PCR-based gene expression, genotyping, digital PCR, and copy number variant analysis by processing IFCs prior to analysis on Biomark HD or EP1 platforms.	Library preparation for targeted DNA sequencing on NGS systems. End-Point PCR, SNP Genotyping, sample identification, Gene Expression, and digital PCR

Analytical Instruments:

Biomark HD System	Real-time PCR analytical instrument for microfluidics-based analysis of gene expression, single-cell targeted gene expression, microRNA expression, sample identification, SNP genotyping, and real-time digital PCR.	SNP Genotyping, sample identification, Digital PCR, and Gene Expression, including Single-Cell Targeted Gene Expression
EP1 System	End-point PCR analytical instrument for microfluidics-based analysis of SNP genotyping and end-point digital PCR.	SNP Genotyping, sample identification, and Digital PCR

Integrated Fluidic Circuits (IFCs):

LP IFCs	Library Preparation IFCs to support targeted DNA sequencing of 48 or 192 samples on NGS instruments.	Library preparation for targeted next-generation DNA sequencing
Juno Genotyping IFC	IFC that incorporates preamplification for genotyping of 96 samples and 96 markers on a single run.	Genotyping, sample identification
Dynamic Array IFCs	IFCs based on matrix architecture, allowing users to (i) individually assay up to 24 samples against up to 192 assays, (ii) individually assay up to 48 samples against up to 48 assays, (iii) individually assay up to 96 samples against up to 96 assays, or (iv) individually assay up to 192 samples against up to 24 assays.	Real-time qPCR, End-Point PCR, SNP Genotyping and Gene Expression, including Single-Cell Targeted Gene Expression, sample identification, copy number variant analysis
Digital Array IFCs	IFCs based on partitioning architecture allowing users to (i) individually assay up to 12 samples or panels across 765 chambers, or to (ii) individually assay up to 48 samples across 770 chambers per IFC.	Digital PCR, Copy Number Variation and Variant Detection
Flex Six IFC	IFC that incorporates six 12 X 12 partitions that can be organized in any configuration, in up to six separate experimental runs.	Gene Expression and SNP Genotyping

Assays and Reagents:

Advanta RNA-Seq NGS Library Prep Kit	Integrated solution for automated NGS library prep. Used with The Juno system with the Advanta RNA-Seq reagents and 48.Atlas integrated fluidic circuit, supports simultaneous processing of up to 48 total RNA samples.	Library preparation for next-generation DNA sequencing
Delta Gene and SNP Type Assays	Custom designed assays targeted to genomic regions of interest for genotyping and gene expression.	Gene Expression, Single-Cell Targeted Gene Expression, SNP Genotyping
Access Array Target-Specific Primers and Targeted Sequencing Prep Primers	Custom designed assays for NGS library preparation using Access Array chemistry on the Access Array or Juno systems.	Library preparation for targeted next-generation DNA sequencing
Targeted DNA Seq Library Assays	Custom designed assays for NGS library preparation using Targeted DNA Sequencing Library Preparation chemistry on the Access Array or Juno systems.	Library preparation for targeted next-generation DNA sequencing

Single Cell Microfluidics

Preparatory Instrument:

C1 System	Sample preparation system that rapidly and reliably isolates and processes individual cells for genomic analysis.	Single-Cell Targeted Gene Expression, Single-Cell microRNA Analysis, Single-Cell mRNA Sequencing (Full Length and End-Counting), Single-Cell Targeted DNA Sequencing, Single-Cell Whole Exome Sequencing, and Single-Cell Whole Genome DNA Sequencing, Single-Cell Epigenetics, Total RNA sequencing, T-ATAC-seq, REAP-Seq (RNA and Protein)

Preparatory Analytical Instruments:

Polaris System	System and IFC that enables single cell contextual studies by facilitating active/live cell selection, isolation, imaging, dosing, and cell culturing workflows.	Functional Genomics Using Single-Cell mRNA Sequencing
C1 IFCs	IFCs that capture up to 800 cells between 5-25 microns in diameter and then automatically process the cells for a variety of genomic analysis using thermal and pneumatic controls at nanoliter scale.	Single-Cell Targeted Gene Expression, Single-Cell microRNA Analysis, Single-Cell mRNA Sequencing (Full Length and End-Counting), Single-Cell Targeted DNA Sequencing, Single-Cell Whole Exome DNA Sequencing, and Single-Cell Whole Genome DNA Sequencing, Total RNA sequencing, T-ATAC-seq, REAP-Seq (RNA and Protein). Additional customer and 3rd-party developed applications available through Fluidigm Script Hub
Polaris IFC	IFC that actively selects, captures and cultures up to 48 single-cells for up to 24 hours. It integrates media exchange, dosing and time course studies followed by cell lysis, reverse transcriptions and library preparation for single cell mRNA sequencing.	Functional Genomics of Single Cells

Technology

Multi-Layer Soft Lithography

Our IFCs are manufactured using multi-layer soft lithography (MSL) technology to create valves, chambers, channels and other fluidic components on our IFCs that allow nanoliter quantities of fluids to be precisely manipulated within the IFC. We have developed commercial manufacturing processes to fabricate valves, channels, vias, and chambers with dimensions in the ten to 100 micron range, at high density and with high yields.

Integrated Fluidic Circuits

Our IFCs incorporate several different types of technology that together enable us to use MSL technology to rapidly design and deploy new microfluidic applications. The first level of our IFC technology is a library of components that perform basic microfluidic functions, such as pumps, mixers, single-cell capture chambers, separation columns, control logic, and reaction chambers. The second level of our IFC technology comprises the architectures we have designed to exploit our ability to conduct thousands of reactions on a single IFC. The third level of our IFC technology involves the interaction of our IFCs with the actual laboratory environment. Our IFCs are built on specially designed input frames that are compatible with most commonly used laboratory systems.

Instrumentation and Software

Our mass cytometry instrumentation technology includes a custom-designed inductively coupled plasma ion source, ion-optical and vacuum systems, and instrument control electronics. With our Helios system, which is an enhanced version of our CyTOF 2 system, individual cells are atomized, ionized, and extracted. A time-of-flight mass analyzer separates atomic ions of different mass-to-charge ratios, providing information on temporal distribution of ions. The Hyperion Imaging System combines mass cytometry technology with imaging capability to enable simultaneous interrogation of up to 37 protein markers in the spatial context of the tissue microenvironment. Our systems have the ability to utilize up to 135 channels to detect additional parameters to meet future market needs.

Our Biomark HD system includes our custom thermal cycler, the FC1 cycler, and a sophisticated fluorescence imaging system. Our EP1 instrument is a fluorescence reader designed for end-point imaging, suitable for genotyping and digital PCR applications. Our C1 system combines the hardware elements of our IFC controllers and FC1 cycler with sophisticated scripting and protocol control software to enable automation of single-cell capture and preparation for subsequent analysis. Certain capabilities of the C1 system have been used to create our Juno system, which serves as a universal controller and cycler for our Dynamic Array IFCs. Our Polaris system combines the capabilities of all these instruments by incorporating thermal cycling, IFC control, environmental regulation, and imaging.

We have developed instrumentation technology to load samples and reagents onto our IFCs and to control and monitor reactions within our IFCs. Our line of IFC controllers consists of commercial pneumatic components and both custom and commercial electronics. They apply precise control of multiple pressures to move fluid and control valve states in a microfluidic IFC.

We have also developed specialized software to manage and analyze the unusually large amounts of data produced by our systems. We offer Fluidigm Cytobank, our cloud-based platform of analytical tools, for use with the Helios system. Our bioinformatic toolset, the Singular software, facilitates the analysis and visualization of single-cell gene expression data. More recently, we extended the scope of the toolset to include DNA analysis tools. We also developed the C1 Script Builder software to enable customers to take full advantage of the flexibility of C1 IFC architecture by allowing them to program their own control scripts for the C1 system.

Assays and Reagents

We manufacture metal-conjugated antibodies for use with our mass cytometry instruments to allow detection of up to approximately 44 protein targets simultaneously in a single cell for a total of more than 50 detected cellular parameters. Our metal-conjugated antibodies are manufactured using metal-chelating polymers, which are produced using proprietary polymerization processes and subsequent post-polymerization modifications.

Our Delta Gene and single-nucleotide polymorphism type (SNP Type) assay products consist of assay design and custom content delivery systems for gene expression and genotyping, respectively. These offerings provide low-cost alternatives to other available chemistries and allow customers to use IFCs in more flexible ways. PCR assay reagents need to be specific to the gene targets of interest but the process of designing a set of assays may delay the implementation experiments or require the use of expensive pre-designed assays. We have developed a process to provide customers with validated assays for their targets of interest.

Life Science Research

Our products enable comprehensive interrogation of biological samples across a range of genomic and protein molecular biomarkers.

Genomics

One primary area of focus within life science research is genetic analysis, the study of genes and their functions. The hereditary material or nucleic acid of an organism is often referred to as its genome, the protein-encoding regions of which are commonly known as genes. Analysis of variations in genomes, genes and gene activity in and between organisms can provide valuable insight into their health and functioning. Single-cell genomics is the study of the sequence and expression of genes and their ultimate functions at the individual cell level.

There are several forms of genetic analysis in use today, including genotyping, gene expression analysis and DNA sequencing:

- Genotyping involves the analysis of DNA variations across individual genomes. There are multiple forms of variants, including single nucleotide polymorphism (SNPs), insertion-deletions and copy number variation. A common application of genotyping focuses on analyzing SNPs to determine whether a SNP or group of SNPs are associated with a particular genetic trait, such as propensity for a disease.

- Gene expression analysis involves measuring the levels of particular ribonucleic acid sequences known as messenger RNAs (mRNAs), which have been transcribed from genes. Determining these levels is important because mRNAs are often translated by the cell into proteins and may affect the activity of the cell or the larger organism.

- DNA sequencing is a process by which researchers are able to determine the particular order of nucleotide bases that comprise all or a portion of a particular gene or genome, and typically improves with target enrichment, such as complex sample preparation and tagging processes. Researchers are increasingly using next-generation DNA sequencers to rapidly and cost-effectively sequence portions of genomes, which is important for the identification of genetic variations that correlate with particular phenotypes.

Gene expression and genotyping are studied through a combination of various technology platforms that characterize gene function and genetic variation. These platforms often rely on PCR amplification to generate exponential copies of a DNA sample to provide sufficient signal to facilitate detection. Real-time quantitative PCR (real-time qPCR) is a more advanced form of PCR that makes it possible to quantify the number of copies of DNA present in a sample.

Proteomics

Another focus within life science research is protein analysis, the study of proteins and their structures and functions. Proteins perform a vast array of functions within living organisms, including catalyzing metabolic reactions, replicating DNA, signaling response to stimuli and transporting molecules from one location to another. The proteome varies and is dynamic. Every cell in an individual organism has the same set of genes, but the set of proteins produced in different tissues differ from one another and are dependent on gene expression. Protein analysis is required to profile and understand cellular function as well as the interaction in tissues and other complex microenvironments.

There are several forms of high-throughput protein analysis in use today, including mass spectrometry, traditional flow cytometry, immunohistochemistry and both suspension and imaging mass cytometry.

- Mass spectrometry is an analytical chemistry technique that measures the mass-to-charge ratio in molecules using external electric and magnetic fields. Mass spectrometry techniques are limited to bulk samples and provide an understanding of global protein dynamics on a tissue or organism level, but do not, by themselves, enable researchers to analyze data at a single cell level.

- Traditional flow cytometry utilizes a suspension of cells in a stream of fluid and passes them through an electronic detection apparatus to allow simultaneous multi-parameter analysis of the physical and chemical characteristics of up to thousands of cells per second. Although traditional flow cytometry technologies are high-throughput with single-cell analysis capabilities, a key limitation is the use of fluorescent dyes to label antibodies for detection. These fluorescent labels have emission spectra that typically overlap, making it challenging to optimize reagents to analyze many protein markers at once. In general, the number of protein targets for conventional flow cytometry is less than about 10 with significant reagent optimization often involved.

- Immunohistochemistry is a method by which cells in a tissue section are stained with antibodies and then imaged with a conventional or fluorescent microscope. Antibodies selected to bind to proteins of interest can be conjugated with either chromogenic or fluorescent labels, allowing cellular proteins to be visualized in spatial context. Immunohistochemistry is used broadly throughout the life sciences industry, and in clinical research to better understand the characteristics and relationship of cancerous versus normal cells in biopsy tissue. In general, the number of simultaneously imageable proteins is less than five, with researchers only able to achieve a higher-parameter resolution using serial sections (several adjacent sections of the same tissue) or other highly laborious, more serial staining methods.

- Suspension mass cytometry is similar to traditional flow cytometry but is based primarily on antibodies using heavy metal isotope labels rather than fluorescent labels for detection of proteins, enabling the significant expansion of the number of parameters analyzed per individual cell versus conventional flow cytometry technologies. With high-throughput, single-cell analysis capabilities and the ability to analyze more protein markers per individual cell, researchers have more granular information, which allows them to identify and characterize even finer subpopulations of cells.

- Imaging mass cytometry is similar to immunohistochemistry, but is also based primarily on antibodies using heavy metal isotope labels rather than fluorescent or chromogenic labels for detection of proteins. This method enables a significant expansion of the number of parameters simultaneously analyzed per tissue section rather than in adjacent sections or via serial staining protocols.

Customers

We sell our instruments for research use only to leading academic research institutions, translational research and medicine centers, cancer centers, clinical research laboratories, and biopharmaceutical, biotechnology, and plant and animal research companies. No single customer represented more than 10% of our total revenue for 2019, 2018, or 2017.

Marketing, Sales, Service and Support

We distribute our systems through our direct sales force and support organizations located in North America, Europe, and Asia-Pacific, and through distributors or sales agents in several European, Latin American, Middle Eastern, and Asia-Pacific countries. Our sales and marketing efforts are targeted at laboratory directors and principal investigators at leading academic, translational research, healthcare consortiums, and biopharmaceutical companies who need reliable life science automation solutions to power their disease research with the goal of providing actionable insights.

Our sales process often involves numerous interactions and demonstrations with multiple people within an organization. Some potential customers conduct in-depth evaluations of the system, including running experiments on our system and competing 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. As a result 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 12 months or longer.

As of December 31, 2019, we had 187 people employed in sales, technical support, and marketing.

Manufacturing

Our manufacturing operations are primarily located in Singapore and Canada. Our facility in Singapore manufactures our IFCs and manages production of our genomics instruments, which are assembled by our contract manufacturer located within our Singapore facility. All of our IFCs for commercial sale and some IFCs for our research and development purposes are also fabricated at our Singapore facility. Our mass cytometry instruments for commercial sale, as well as for internal research and development purposes, are manufactured at our facility in Canada. As part of our on-going efforts related to operational excellence and improving efficiencies, we consolidated our North American production of reagents for mass cytometry activities into our Canadian facility in 2019.

We rely on a limited number of suppliers for certain components and materials used in our products. Key components in our products that are supplied by sole or limited source suppliers include a specialized polymer and other specialized materials from which our IFC cores are fabricated, specialized custom camera lenses, fiber light guides, and other components required for the reader of our Biomark system; specialized pneumatic and electronic components for our C1, Juno, Callisto, and Polaris systems; the electron multiplier detector included in, and certain metal isotopes used with, our Helios system; specially developed lasers used in our Hyperion Imaging System; and certain raw materials for our Delta Gene and SNP Type assays and Access Array Target-Specific primers. The loss of a single or sole source supplier would require significant time and effort to locate and qualify an alternative source of supply, if at all, and could adversely impact our business. For additional information, please see the section entitled “Risk factors” in Part I, Item 1A of this Form 10-K.

Research and Development

We have assembled experienced research and development teams at our South San Francisco, California, Markham, Ontario, Canada, and Singapore locations with the scientific, engineering, software, bioinformatic, and process talent that we believe is required to grow our business.

The largest component of our current research and development effort is in the areas of new products, new applications and new content. In the area of mass cytometry, we developed an initial prototype imaging mass cytometer instrument in 2016, and successfully launched the commercial Hyperion Imaging System in October 2017. The imaging mass cytometer system provides spatial resolution of protein expression in complex tissue samples at the single-cell level, quantitative measurement using metal isotope tags, and analysis of up to 37 proteins. We also developed metal-labeled antibodies compatible with formalin fixed paraffin embedded tissue samples, to be used with the Hyperion. We also invest significantly in research and development efforts to expand our single-cell and production genomics applications. For example, we continue to develop and commercialize various panel sets for cancer research for use with our systems. In 2017, we successfully launched the Advanta™ Immuno-Oncology Gene Expression Assay, which is a 170-gene expression qPCR assay that enables profiling of tumor immunobiology and new biomarker identification. In 2019, we launched the Advanta™ RNA-Seq NGS Library Prep Kit. Designed to drive significant improvement in the RNA-seq workflow, the Advanta RNA-Seq NGS Library Prep Kit together with the Juno™ system delivers an integrated solution for automated, cost-efficient NGS library prep.

In 2019, we launched the Maxpar Direct Immune Profiling Assay, a sample-to-answer workflow for comprehensive human immune profiling for use with our Helios system, that puts pre-titrated antibodies in dry format in a single tube, with automated software that provides data analysis in as few as five minutes. This assay is reproducible from site-to-site and lot-to-lot, which is important for translational and pharma/biotech research work. We have collaborated with industry partners to enable workflows and software for both the Helios and Hyperion systems. Also in 2019, we added seven new metal antibody labels, becoming the first company to enable 50-plex cytometry panels, and launched three Imaging Mass Cytometry Panel Kits as well as CyTOF7.0, an advanced CyTOF software.

The second component of our research and development effort is to continuously develop new manufacturing processes and test methods to drive down manufacturing costs, increase manufacturing throughput, widen fabrication process capability, and support new microfluidic devices and designs.

Our research and development expenses were $31.6 million, $30.0 million and $30.8 million in 2019, 2018, and 2017 respectively. As of December 31, 2019, 123 of our employees were engaged in research and development activities.

Competition

The life science markets are highly competitive and expected to grow more competitive with the increasing knowledge gained from ongoing research and development. We believe that the principal competitive factors in our target markets include competition for human resources; cost of capital equipment and supplies; reputation among customers; innovation in product offerings; flexibility and ease of use; accuracy and reproducibility of results; and compatibility with existing laboratory processes, tools, and methods.

We compete with both established and development stage life science companies that design, manufacture, and market instruments for gene expression analysis, genotyping, other nucleic acid detection, protein expression analysis, imaging, and additional applications. In addition, a number of other companies and academic groups are in the process of developing novel technologies for life science markets. Many of our competitors enjoy several competitive advantages over us, including significantly greater name recognition; greater financial and human resources; broader product lines and product packages; larger sales forces and eCommerce channels; larger and more geographically dispersed customer support organization; substantial intellectual property portfolios; larger and more established customer bases and relationships; greater resources dedicated to marketing efforts; better established and larger scale manufacturing capability; and greater resources and longer experience in research and development. For additional information, please see the section entitled “Risk factors” in Part I, Item 1A of this Form 10-K.

To successfully compete with existing products and future technologies, we need to demonstrate to potential customers that the performance of our technologies and products, the solutions we provide our customers, as well as our customer support capabilities, are superior to those of our competitors. To differentiate our company from other, larger enterprises, we need to introduce new and innovative offerings regularly and maintain a well-staffed commercial team “in the field” to successfully communicate the advantages of our products and overcome potential obstacles to acceptance of our products. In addition, ongoing collaborations and partnerships with key opinion leaders are desirable to demonstrate both biological innovation and applications that solve customer problems.

Intellectual Property

Patents

We have developed a portfolio of issued patents and patent applications directed to commercial products and technologies in development. As of December 31, 2019, we owned or licensed over 520 patents and we had approximately 158 pending patent applications worldwide. Our patents have expiration dates ranging up to 2036.

License Agreements

We have entered into licenses for technologies from various companies and academic institutions.

Microfluidic Technologies. Our core microfluidics technology originated at the California Institute of Technology (Caltech) in the laboratory of Professor Stephen Quake, who is a co-founder of Fluidigm. We license microfluidics technology from Caltech, Harvard University, and Caliper Life Sciences, Inc. (Caliper), now a PerkinElmer company:

- We exclusively license from Caltech relevant patent filings relating to developed technologies that enable the production of specialized valves and pumps capable of controlling fluid flow at nanoliter volumes. The license agreement will terminate as to each country and licensed product upon expiration of the last-to-expire patent covering licensed products in each country. The U.S. issued patents we have licensed from Caltech expire between 2017 and 2030.

- We have entered into a co-exclusive license agreement with Harvard University for the license of relevant patent filings relating to microfluidic technology. The license agreement will terminate with the last-to-expire of the licensed patents. The U.S. issued patents we have licensed from Harvard University expire between 2019 and 2027.

- In May 2011, we entered into a license agreement with Caliper to license Caliper's existing patent portfolio in certain fields. The license agreement will terminate with the last-to-expire of the licensed patents. As later amended, the license agreement provides for certain royalty payments until mid-2018 for our existing products at the time of amendment and their future equivalents.

Instrumentation and Digital PCR. On June 30, 2011, we settled litigation and entered into a series of patent cross-license and sub-license agreements with Life Technologies Corporation (now part of Thermo Fisher Scientific Inc.) and its subsidiary Applied Biosystems, LLC (Life). The agreements involve a cross-license concerning our imaging readers and other patent filings and certain of Life's patent families relating to methods and instruments for conducting nucleic acid amplification, such as with PCR; a sub-license that provides us access to certain of Life's digital PCR patents; and a sublicense that provides Life access to certain of our non-core technology patents licensed from Caltech. In July 2011, pursuant to the terms of the agreements, we paid Life $2.0 million in connection with our exercise of an option to preclude Life from initiating litigation under its patents existing as of June 30, 2011 against our customers for two years and against our company, with respect to our current products and equivalent future products, for four years, subject to certain exceptions. In November 2017, we settled pending litigation with Life and, pursuant to the terms of the settlement, one of the patent license agreements was amended to provide Life with a fully paid-up license under the patents covered by the agreement, subject to certain field of use restrictions. The license agreement will terminate with the last-to-expire of the licensed patents, which is expected to be in 2028.

Mass Cytometry. Some of the intellectual property rights covering our mass cytometry products were subject to a license agreement (the Original License Agreement) between Fluidigm Canada Inc. (Fluidigm Canada), and PerkinElmer Health Sciences, Inc. (PerkinElmer). Under the Original License Agreement, Fluidigm Canada received an exclusive, royalty bearing, worldwide license to certain patents owned by PerkinElmer in the field of inductively coupled plasma (ICP) -based mass cytometry, including the analysis of elemental tagged materials in connection therewith (the Patents), and a non-exclusive license for reagents outside the field of ICP-based mass cytometry. On November 4, 2015, we entered into a patent purchase agreement with PerkinElmer pursuant to which we purchased the Patents for a purchase price of $6.5 million and a patent assignment agreement pursuant to which PerkinElmer transferred and assigned to us all rights, title, privileges, and interest in and to the Patents and the Original License Agreement. Accordingly, we have no further financial obligations to PerkinElmer under the Original License Agreement. Contemporaneously with the purchase of the Patents, we entered into a license agreement with PerkinElmer pursuant to which we granted PerkinElmer a worldwide, non-exclusive, fully paid-up license to the Patents in fields other than (i) ICP-based mass analysis of atomic elements associated with a biological material, including any elements that are unnaturally bound, directly or indirectly, to such biological material (Mass Analysis) and (ii) the development, design, manufacture, and use of equipment or associated reagents for such Mass Analysis. The license will terminate on the last expiration date of the Patents, currently expected to be in December 2025, unless earlier terminated pursuant to the terms of the license agreement.

Any loss, termination, or adverse modification of our licensed intellectual property rights could have a material adverse effect on our business, operating results, and financial condition. For additional information, please see the section entitled "Risk factors" in Part I, Item 1A of this Form 10-K.

Other

In addition to pursuing patents and licenses on key technologies, 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, when needed, our advisers.

Government Regulation

Our products are currently labeled and sold for research purposes only, and we sell them to academic institutions, life sciences and clinical research laboratories that conduct research, and biopharmaceutical and biotechnology companies for non-diagnostic and non-clinical purposes. Our products are not intended or promoted for use in clinical practice in the diagnosis of disease or other conditions, and they are labeled for research use only, not for use in diagnostic procedures. Accordingly, they are not subject to regulation by the U.S. Food and Drug Administration (FDA). Rather, while FDA regulations require that research use only products be labeled, “For Research Use Only. Not for use in diagnostic procedures,” or RUO products, the regulations do not subject such products to the FDA’s jurisdiction or the broader pre- and post-market controls for medical devices.

In November 2013, the FDA issued a final guidance document stating that merely including a labeling statement that the product is for research purposes only will not necessarily render the device exempt from the FDA’s clearance, approval, or other regulatory requirements if the totality of circumstances surrounding the distribution of the product indicate that the manufacturer knows its product is being used by customers for diagnostic uses or the manufacturer intends such a use. These circumstances may include, among other things, written or verbal marketing claims regarding a product’s performance in clinical diagnostic applications and a manufacturer’s provision of technical support for such activities. In the future, certain of our products or related applications could become subject to regulation as medical devices by the FDA. If we wish to label and market our products for use in performing clinical diagnostics, thus subjecting them to regulation by the FDA under premarket and postmarket control as medical devices, unless an exemption applies, we would be required to obtain either prior 510(k) clearance or prior pre-market approval from the FDA before commercializing the product. The FDA classifies medical devices into one of three classes. Devices deemed to pose lower risk to the patient are placed in either class I or II, which, unless an exemption applies, requires the manufacturer to submit a pre-market notification requesting FDA clearance for commercial distribution pursuant to Section 510(k) of the FFDCA. This process, known as 510(k) clearance, requires that the manufacturer demonstrate that the device is substantially equivalent to a previously cleared and legally marketed 510(k) device or a “pre-amendment” class III device for which pre-market approval applications (PMAs) have not been required by the FDA. This FDA review process typically takes from four to twelve months, although it can take longer. Most class I devices are exempted from this 510(k) premarket submission requirement. Devices deemed by the FDA to pose the greatest risk, such as life-sustaining, life-supporting, or implantable devices, or those deemed not substantially equivalent to a legally marketed predicate device, are placed in class III. Class III devices typically require PMA approval. To obtain PMA approval, an applicant must demonstrate the reasonable safety and effectiveness of the device based, in part, on data obtained in clinical studies. PMA reviews generally last between one and two years, although they can take longer. Both the 510(k) and the PMA processes can be expensive and lengthy and may not result in clearance or approval. If we are required to submit our products for pre-market review by the FDA, we may be required to delay marketing and commercialization while we obtain premarket clearance or approval from the FDA. There would be no assurance that we could ever obtain such clearance or approval.

In some cases, our customers may use our RUO products in their own laboratory-developed tests (LDTs) or in other FDA-regulated products for clinical diagnostic use. The FDA has historically exercised enforcement discretion in not enforcing the medical device regulations against LDTs and LDT manufacturers. However, on October 3, 2014, the FDA issued two draft guidance documents that set forth the FDA’s proposed risk-based framework for regulating LDTs, which are designed, manufactured, and used within a single laboratory. In January 2017, the FDA announced that it would not issue final guidance on the oversight of LDTs and LDT manufacturers, but would seek further public discussion on an appropriate oversight approach and give Congress an opportunity to develop a legislative solution. More recently, the FDA has issued warning letters to genomics labs for illegally marketing genetic tests that claim to predict patients’ responses to specific medications, noting that the FDA has not created a legal “carve-out” for LDTs and retains discretion to take action when appropriate, such as when certain genomic tests raise significant public health concerns. As laboratories and manufacturers develop more complex genetic tests and diagnostic software, the FDA may increase its regulation of LDTs. Any future legislative or administrative rule making or oversight of LDTs and LDT manufacturers if and when finalized, may impact the sales of our products and how customers use our products, and may require us to change our business model in order to maintain compliance with these laws.

We would become subject to additional FDA requirements if our products are determined to be medical devices or if we elect to seek 510(k) clearance or pre-market approval. We would need to continue to invest significant time and other resources to ensure ongoing compliance with FDA quality system regulations and other post-market regulatory requirements. For additional information, please see the section entitled “Risk factors” in Part I, Item 1A of this Form 10-K.

International sales of medical devices are subject to foreign government regulations, which vary substantially from country to country. Outside of the EU, regulatory approval needs to be sought on a country-by-country basis in order to market medical devices. Although there is a trend towards harmonization of quality system, standards and regulations in each country may vary substantially which can affect timelines of introduction.

Environmental Matters

We are subject to many federal, state, local, and foreign environmental regulations. To comply with applicable regulations, we have and will continue to incur significant expense and allocate valuable internal resources to manage compliance-related issues. In addition, such regulations could restrict our ability to expand or equip our facilities, or could require us to acquire costly equipment or to incur other significant expenses to comply with the regulations. For example, the Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Directive (RoHS) and the Waste Electrical and Electronic Equipment Directive (WEEE), both enacted in the European Union, regulate the use of certain hazardous substances in, and require the collection, reuse, and recycling of waste from, products we manufacture. Certain of our products sold in these countries are subject to RoHS and WEEE requirements. If we fail to comply with any present and future regulations, we could be subject to future fines, penalties, and restrictions, such as the suspension of manufacturing of our products or a prohibition on the sale of products we manufacture. For additional information, please see the section entitled "Risk factors" in Part I, Item 1A of this Form 10-K.

Additionally, our research and development and manufacturing processes involve the controlled use of hazardous materials, including flammables, toxics, corrosives, and biologics. Our research and manufacturing operations produce hazardous biological and chemical waste products. We seek to comply with applicable laws regarding the handling and disposal of such materials. The volume of such materials used or generated at our facilities is small. However, we cannot eliminate the risk of accidental contamination or discharge and any resultant injury from these materials. We do not currently maintain separate environmental liability coverage and any such contamination or discharge could result in significant cost to us in penalties, damages, and suspension of our operations.

Geographic Area Information

During the last three years, a significant portion of our revenue was generated outside of the United States. Total revenue received from customers outside the United States equaled $73.9 million, or 63% of our total revenue, in 2019, compared to $64.8 million, or 57% of our total revenue, in 2018, and $56.1 million, or 55% of our total revenue, in 2017. The majority of our long-lived assets are located within the United States, in Singapore and in Canada. Please see Note 3 and Note 12 to our audited consolidated financial statements for additional information regarding geographic areas.

Seasonality

Our business is not subject to significant seasonality. However, the timing of customer orders and shipments, customer budget and spending cycles, and new product releases can result in variability in our quarterly revenues.

Raw Materials

Certain raw materials used in our Delta Gene and SNP Type assays and Access Array target-specific primers are available from a limited number of sources. Additionally, certain metals used in our Maxpar reagents are available from a sole source. Currently, we do not have supply agreements with these suppliers. While we generally attempt to keep our inventory at minimal levels, we purchase incremental inventory as circumstances warrant to protect our supply chain.

Backlog

We manufacture products based on forecasts of our customers' demand and advance non-binding commitments from customers as to future purchases. Our customers generally do not place purchase orders far in advance. A substantial portion of our products are sold on the basis of standard purchase orders that are cancellable prior to shipment without penalty. Accordingly, backlog at any given time is not a meaningful indicator of future sales.

Employees

As of December 31, 2019, we had 566 employees, of which 123 work in research and development, 134 work in general and administrative, 122 work in manufacturing, and 187 work in sales, technical support, and marketing. None of our employees are represented by a labor union nor are they subject to a collective bargaining agreement.

Corporate and Available Information

We were incorporated in California in May 1999 as Mycometrix Corporation, changed our name to Fluidigm Corporation in April 2001, and reincorporated in Delaware in July 2007. Our principal executive offices are located at 7000 Shoreline Court, Suite 100, South San Francisco, California 94080, until March 13, 2020, and thereafter will be located at Two Tower Place, South San Francisco, California 94080. Our telephone number is (650) 266-6000. Our website address is www.fluidigm.com. We make available on our website, free of charge, our Annual Report on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, and any amendments to those reports, as soon as reasonably practicable after we electronically file such material with, or furnish it to, the Securities and Exchange Commission (SEC). Our SEC reports can be accessed through the investor relations page of our website located at http://investors.fluidigm.com. The SEC also maintains an Internet site at www.sec.gov that contains reports, proxy and information statements, and other information regarding issuers that electronically file with the SEC.

The contents of our website are not a part of, and are not incorporated by reference into, this Annual Report on Form 10-K or any other report or document we file with the SEC. Any reference to our website is intended to be an inactive textual reference only.

We intend to use our website, www.fluidigm.com as a means of disclosing material non-public information and for complying with our disclosure obligations under SEC Regulation FD. Such disclosures will be included on our website under “About Us > Investors.” Accordingly, investors should monitor the “Investors” section of our website, in addition to following our press releases, SEC filings, and public conference calls and webcasts.

ITEM 1A. RISK FACTORS

We operate in a rapidly changing environment that involves numerous uncertainties and risks. The following risks and uncertainties may have a material and adverse effect on our business, financial condition, or results of operations. You should consider these risks and uncertainties carefully, together with all of the other information included or incorporated by reference in this Form 10-K. The risks described below are not the only ones we face. Our business is also subject to the risks that affect many other companies, such as employment relations, general economic conditions, geopolitical events and international operations. Further, additional risks not currently known to us or that we currently believe are immaterial may in the future materially and adversely affect our business, operations, liquidity and stock price. If any of the risks or uncertainties we face were to occur, the trading price of our securities could decline, and you may lose all or part of your investment.

Risks Related to Fluidigm's Business and Strategy

Our financial results and revenue growth rates have varied significantly from quarter-to-quarter and year-to-year due to a number of factors, and a significant variance in our operating results or rates of growth, if any, could lead to substantial volatility in our stock price.

Our revenue, results of operations, and revenue growth rates have varied in the past and may continue to vary significantly from quarter-to-quarter or year-to-year. We may experience substantial variability in our product mix from period-to-period as revenue from sales of our instruments relative to sales of our consumables may fluctuate or deviate significantly from expectations. For example, our revenue declined year-over-year in 2017 compared to 2016, but increased year-over-year in 2018 compared to 2017. Our revenue continued to increase year-over-year in 2019 compared to 2018, but we may not be able to achieve similar revenue growth in future periods. We are also increasingly dependent on our mass cytometry business, which is very capital intensive. Variability in our quarterly or annual results of operations, mix of product revenue, including any decline in our mass cytometry revenue, or variability in rates of revenue growth, if any, may lead to volatility in our stock price as research analysts and investors respond to these fluctuations. These fluctuations are due to numerous factors that are difficult to forecast, including: fluctuations in demand for our products; changes in customer budget cycles and capital spending; seasonal variations in customer operations; tendencies among some customers to defer purchase decisions to the end of the quarter; the large unit value of our systems, particularly our proteomics systems; changes in our pricing and sales policies or the pricing and sales policies of our competitors; our ability to design, manufacture, market, sell, and deliver products to our customers in a timely and cost-effective manner; fluctuations or reductions in revenue from sales of legacy instruments that may have contributed significant revenue in prior periods; quality control or yield problems in our manufacturing operations; our ability to timely obtain adequate quantities of the materials or components used in our products, which in certain cases are purchased through sole and single source suppliers; new product introductions and enhancements by us and our competitors; unanticipated increases in costs or expenses; our complex, variable and, at times, lengthy sales cycle; global economic conditions; and fluctuations in foreign currency exchange rates. Additionally, we have certain customers who have historically placed large orders in multiple quarters during a calendar year. A significant reduction in orders from one or more of these customers could adversely affect our revenue and operating results, and if these customers defer or cancel purchases or otherwise alter their purchasing patterns, our financial results and actual results of operations could be significantly impacted. Other unknown or unpredictable factors also could harm our results.

The foregoing factors, as well as other factors, could materially and adversely affect our quarterly and annual results of operations and rates of revenue growth, if any. We have experienced significant revenue growth in the past but we may not achieve similar growth rates in future periods. You should not rely on our operating results for any prior quarterly or annual period as an indication of our future operating performance. If we are unable to achieve adequate revenue growth, our operating results could suffer and our stock price could decline. In addition, a significant amount of our operating expenses are relatively fixed due to our manufacturing, research and development, and sales and general administrative efforts. Any failure to adjust spending quickly enough to compensate for a shortfall relative to our anticipated revenue could magnify the adverse impact of such shortfalls on our results of operations. We expect that our sales will continue to fluctuate on an annual and quarterly basis and that our financial results for some periods may be below those projected by securities analysts, which could significantly decrease the price of our common stock.

We have incurred losses since inception, and we may continue to incur substantial losses for the foreseeable future.

We have incurred significant losses in each fiscal year since our inception, including net losses of $64.8 million, $59.0 million, and $60.5 million during the years 2019, 2018, and 2017, respectively. As of December 31, 2019, we had an accumulated deficit of $623.6 million. These losses have resulted principally from costs incurred in our research and development programs, and from our manufacturing costs and selling, general, and administrative expenses. To date, we have funded our operations primarily through equity offerings, the issuance of debt instruments, and from sales of our products.

Until we are able to generate additional revenue to support our level of operating expenses, we will continue to incur operating and net losses and negative cash flow from operations. We believe that our continued investment in research and development, sales, and marketing is essential to our long-term competitive position and future revenue growth and, as a result, we may incur operating losses for the foreseeable future and may never achieve profitability.

The life science markets are highly competitive and subject to rapid technological change, and we may not be able to successfully compete.

The markets for our products are characterized by rapidly changing technology, evolving industry standards, changes in customer needs, emerging competition, new product introductions, and strong price competition. We compete with both established and development stage life science research companies that design, manufacture, and market instruments and consumables for gene expression analysis, single-cell targeted gene expression and protein expression analysis, SNP genotyping, quantitative polymerase chain reaction (qPCR), digital PCR, flow cytometry, cell imaging, and additional applications using well established laboratory techniques, as well as newer technologies such as bead encoded arrays, microfluidics, next generation DNA sequencing, microdroplets, spatial protein expression, and photolithographic arrays. Most of our current competitors have significantly greater name recognition, greater financial and human resources, broader product lines and product packages, larger sales forces, larger existing installed bases, larger intellectual property portfolios, and greater experience and scale in research and development, manufacturing, and marketing than we do.

We consider Illumina, Inc., Agilent Technologies, Inc., Thermo Fisher Scientific Inc. (Thermo), Bio-Rad Laboratories, Inc., NanoString Technologies, Inc. (NanoString), and Agena Bioscience, Inc. to be our principal competitors in the microfluidics space. We believe that Cytek Biosciences, Inc. and Becton, Dickinson and Company are currently our principal competitors in the mass cytometry markets, and that IonPath Inc., Akoya Biosciences, Inc., and NanoString are our principal competitors in imaging mass cytometry. While the aforementioned principal competitors are the largest and most prevalent in their representative technology areas, the combined markets in which we compete have an additional 10 to 20 smaller competitors with competing approaches and technologies that we routinely face in selling situations.

Competitors may be able to respond more quickly and effectively than we can to new or changing opportunities, technologies, standards, or customer requirements. In light of these advantages, even if our technology is more effective than the product or service offerings of our competitors, current or potential customers might accept competitive products and services in lieu of purchasing our technology. We anticipate that we will continue to face increased competition in the future as existing companies and competitors develop new or improved products and as new companies enter the market with new technologies. Increased competition is likely to result in pricing pressures, which could reduce our profit margins and increase our sales and marketing expenses. In addition, mergers, consolidations, or other strategic transactions between two or more of our competitors, or between our competitor and one of our key customers, could change the competitive landscape and weaken our competitive position, adversely affecting our business.

Market opportunities may not develop as quickly as we expect, limiting our ability to successfully sell our products, or our product development and strategic plans may change and our entry into certain markets may be delayed, if it occurs at all.

The application of our technologies to high-throughput genomics, single-cell genomics and, particularly, mass cytometry applications are in many cases emerging market opportunities. We believe these opportunities will take several years to develop or mature and we cannot be certain that these market opportunities will develop as we expect. The future growth of our markets and the success of our products depend on many factors beyond our control, including recognition and acceptance by the scientific community, and the growth, prevalence, and costs of competing methods of genetic and protein analysis. Additionally, our success depends on the ability of our sales organization to successfully sell our products into these new markets. If we are not able to successfully market and sell our products, or to achieve the revenue or margins we expect, our operating results may be harmed and we may not recover our product development and marketing expenditures. In addition, our product development and strategic plans may change, which could delay or impede our entry into these markets.

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 our potential customers already use expensive research systems in their laboratories and may be reluctant to replace those systems. Market acceptance of our systems will depend on many factors, including our ability to convince potential customers that our systems are an attractive alternative to existing technologies. Compared to some competing technologies, our technology is relatively new, and most 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 customers choosing to retain their existing systems or to purchase systems other than ours, and revenue from the sale of legacy instruments that may have contributed significant revenue in prior periods may decrease.

In addition, it is important that our 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 convincing industry leaders of the advantages of our systems and encouraging such leaders to publish or present the results of their evaluation of our system. If we are unable to continue to induce leading researchers to use our systems, or if such researchers are unable to achieve and 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.

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

We may encounter unforeseen situations in the manufacturing and assembly of our products that would result in delays or shortfalls in our production. For example, our production processes and assembly methods may have to change to accommodate any significant future expansion of our manufacturing capacity, which may increase our manufacturing costs, delay production of our products, reduce our product margin, and adversely impact our business. Conversely, if demand for our products shifts such that a manufacturing facility is operated below its capacity for an extended period, we may adjust our manufacturing operations to reduce fixed costs, which could lead to uncertainty and delays in manufacturing times and quality during any transition period.

Additionally, all of our integrated fluidic circuits (IFCs) for commercial sale are manufactured at our facility in Singapore. Production of the elastomeric block that is at the core of our IFCs is a complex process requiring advanced clean rooms, sophisticated equipment, and strict adherence to procedures. Any contamination of the clean room, equipment malfunction, or failure to strictly follow procedures can significantly reduce our yield in one or more batches. We have in the past experienced variations in yields due to such factors. A drop in yield can increase our cost to manufacture our IFCs or, in more severe cases, require us to halt the manufacture of our IFCs until the problem is resolved. Identifying and resolving the cause of a drop in yield can require substantial time and resources.

Furthermore, developing an IFC for a new application may require developing a specific production process for that type of IFC. While all of our IFCs are produced using the same basic processes, significant variations may be required to ensure adequate yield of any particular type of IFC. Developing such a process can be very time consuming, and any unexpected difficulty in doing so can delay the introduction of a product.

If our manufacturing activities are adversely impacted, or if we are otherwise unable to keep up with demand for our products by successfully manufacturing, assembling, testing, and shipping our products in a timely manner, our revenue could be impaired, market acceptance for our products could be adversely affected and our customers might instead purchase our competitors' products.

If our research and product development efforts do not result in commercially viable products within anticipated timelines, if at all, our business and results of operations will be adversely affected.

Our business is dependent on the improvement of our existing products, our development of new products to serve existing markets, and our development of new products to create new markets and applications that were previously not practical with existing systems. We intend to devote significant personnel and financial resources to research and development activities designed to advance the capabilities of our technology. We have developed design rules for the implementation of our technology that are frequently revised to reflect new insights we have gained about the technology. In addition, we have discovered that biological or chemical reactions sometimes behave differently when implemented on our systems rather than in a standard laboratory environment. Furthermore, many such reactions take place within the confines of single cells, which have also demonstrated unexpected behavior when grown and manipulated within microfluidic environments. As a result, research and development efforts may be required to transfer certain reactions and cell handling techniques to our systems. In the past, product development projects have been significantly delayed when we encountered unanticipated difficulties in implementing a process on our systems. We may have similar delays in the future, and we may not obtain any benefits from our research and development activities. Any delay or failure by us to develop and release new products or product enhancements would have a substantial adverse effect on our business and results of operations.

Our products could have defects or errors, which may give rise to claims against us, adversely affect market adoption of our systems, and adversely affect our business, financial condition, and results of operations.

Our systems utilize novel and complex technology and such systems may develop or contain undetected defects or errors. We cannot assure you that material performance problems, defects, or errors will not arise, and as we increase the density and integration of our systems, these risks may increase. We generally provide warranties that our systems will meet performance expectations and will be free from defects. The costs incurred in correcting any defects or errors may be substantial and could adversely affect our operating margins. For example, we have experienced a performance issue with respect to certain IFCs used in our C1 systems due to the presence of more than one cell in an IFC chamber. Although we have redesigned such C1 IFCs, we may experience additional unexpected product defects or errors that could affect our ability to adequately address these performance issues.

In manufacturing our products, including our systems, IFCs, and assays, we depend upon third parties for the supply of various components, many of which require a significant degree of technical expertise to produce. In addition, we purchase certain products from third-party suppliers for resale. If our suppliers fail to produce components to specification or provide defective products to us for resale and our quality control tests and procedures fail to detect such errors or defects, or if we or our suppliers use defective materials or workmanship in the manufacturing process, the reliability and performance of our products will be compromised.

If our products contain defects, we may experience:

- a failure to achieve market acceptance or expansion of our product sales;
- loss of customer orders and delay in order fulfillment;
- damage to our brand reputation;
- increased cost of our warranty program due to product repair or replacement;
- product recalls or replacements;
- inability to attract new customers;
- diversion of resources from our manufacturing and research and development departments into our service department; and
- legal claims against us, including product liability claims, which could be costly and time consuming to defend and result in substantial damages.

In addition, certain of our products are marketed for use with products sold by third parties. For example, certain of our systems are marketed as compatible with major next-generation DNA sequencing instruments. If such third-party products are not produced to specification, are produced in accordance with modified specifications, or are defective, they may not be compatible with our products. In such case, the reliability and performance of our products may be compromised.

The occurrence of any one or more of the foregoing could negatively affect our business, financial condition, and results of operations.

Our business depends on research and development spending levels of our customers, a reduction in which could limit our ability to sell our products and adversely affect our business.

We expect that our revenue in the foreseeable future will continue to be derived primarily from sales of our systems, IFCs, assays, and reagents to academic research institutions, translational research and medicine centers, cancer centers, clinical research laboratories biopharmaceutical, biotechnology, and plant and animal research companies, and contract research organizations worldwide. Our success will depend upon their demand for and use of our products. Accordingly, the spending policies of these customers could have a significant effect on the demand for our technology. These policies may be based on a wide variety of factors, including concerns regarding any future federal government budget sequestrations, the availability of resources to make purchases, the spending priorities among various types of equipment, policies regarding spending during recessionary periods, and changes in the political climate. In addition, academic, governmental, and other research institutions that fund research and development activities may be subject to stringent budgetary constraints that could result in spending reductions, reduced allocations, or budget cutbacks, which could jeopardize the ability of these customers to purchase our products. Our operating results may fluctuate substantially due to reductions and delays in research and development expenditures by these customers. For example, reductions in capital and operating expenditures by these customers may result in lower than expected sales of our systems, IFCs, assays, and reagents. These reductions and delays may result from factors that are not within our control, such as:

- changes in economic conditions;
- natural disasters;
- changes in government programs that provide funding to research institutions and companies;
- changes in the regulatory environment affecting life science and plant and animal research companies engaged in research and commercial activities;
- differences in budget cycles across various geographies and industries;
- market-driven pressures on companies to consolidate operations and reduce costs;
- mergers and acquisitions in the life science and plant and animal research industries; and
- other factors affecting research and development spending.

Any decrease in our customers' budgets or expenditures, or in the size, scope, or frequency of capital or operating expenditures, could materially and adversely affect our operations or financial condition.

If one or more of our manufacturing facilities become unavailable or inoperable, we will be unable to continue manufacturing our instruments, IFCs, assays and/or reagents and, as a result, our business will be harmed until we are able to secure a new facility.

We manufacture our genomics analytical and preparatory instruments and IFCs for commercial sale at our facility in Singapore and our mass cytometry instruments, assays, and reagents for commercial sale at our facility in Canada. No other manufacturing facilities are currently available to us, particularly facilities of the size and scope of our Singapore and Canada operations. Our facilities and the equipment we use to manufacture our instruments, IFCs, assays, and reagents would be costly to replace and could require substantial lead times to repair or replace. Our facilities may be harmed or rendered inoperable by natural or man-made disasters, which may render it difficult or impossible for us to manufacture our products for some period of time. If any of our facilities become unavailable to us, we cannot provide assurances that we will be able to secure a new manufacturing facility on acceptable terms, if at all. The inability to manufacture our products, combined with our limited inventory of manufactured supplies, may result in the loss of customers or harm our reputation, and we may be unable to reestablish relationships with those customers in the future. Although we possess insurance for damage to our property and the disruption of our business, this insurance may not be sufficient to cover all of our potential losses and may not continue to be available to us on acceptable terms, or at all. If our manufacturing capabilities are impaired, we may not be able to manufacture and ship our products in a timely manner, which would adversely impact our business.

Disruption of our manufacturing facilities or other operations, or in the operations of our customers or business partners, due to earthquake, flood, other natural catastrophic events, health epidemics, or terrorism could result in cancellation of orders, delays in deliveries or other business activities, or loss of customers and could seriously harm our business.

We have significant manufacturing operations in Singapore and Canada and operations in the United States. In addition, our business is international in nature, with our sales, service and administrative personnel and our customers located in numerous countries throughout the world. Operations at our manufacturing facilities and our subcontractors, as well as our other operations and those of our customers, are subject to disruption for a variety of reasons, including work stoppages, acts of war, terrorism, health epidemics (including the outbreak caused by the novel coronavirus COVID-19), fire, earthquake, volcanic eruptions, energy shortages, flooding or other natural disasters. Such disruption could cause delays in, among other things, shipments of products to our customers, our ability to perform services requested by our customers, or the installation of our products at customer sites. We cannot provide any assurance that alternate means of conducting our operations (whether through alternate production capacity or service providers or otherwise) would be available if a major disruption were to occur or that, if such alternate means were available, they could be obtained on favorable terms.

We generate a substantial portion of our revenue internationally and our international business exposes us to business, regulatory, political, operational, financial, and economic risks associated with doing business outside of the United States.

During the years 2019, 2018, and 2017, approximately 63%, 57%, and 55% respectively, of our product and service revenue was generated from sales to customers located outside of the United States. We believe that a significant percentage of our future revenue will continue to come from international sources as we expand our international operations and develop opportunities in other countries. Engaging in international business inherently involves a number of difficulties and risks, including:

- required compliance with existing and changing foreign regulatory requirements and laws that are or may be applicable to our business in the future, such as the European Union's General Data Protection Regulation and other data privacy requirements, labor and employment regulations, anticompetition regulations, the U.K. Bribery Act of 2010 and other anticorruption laws, and the RoHS and WEEE directives, which regulate the use of certain hazardous substances in, and require the collection, reuse, and recycling of waste from, products we manufacture;
- required compliance with U.S. laws such as the Foreign Corrupt Practices Act, and other U.S. federal laws and regulations established by the office of Foreign Asset Control;
- export requirements and import or trade restrictions;
- laws and business practices favoring local companies;
- longer payment cycles and difficulties in enforcing agreements and collecting receivables through certain foreign legal systems;
- changes in social, economic, and political conditions or in laws, regulations and policies governing foreign trade, manufacturing, development, and investment both domestically as well as in the other countries and jurisdictions in which we operate and into which we sell our products, including as a result of the separation of the United Kingdom from the European Union (Brexit);
- potentially adverse tax consequences, tariffs, customs charges, bureaucratic requirements, and other trade barriers;
- difficulties and costs of staffing and managing foreign operations; and
- difficulties protecting or procuring intellectual property rights.

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

We are subject to fluctuations in the exchange rate of the U.S. Dollar and foreign currencies.

A majority of our product sales are currently denominated in U.S. dollars and fluctuations in the value of the U.S. dollar relative to foreign currencies could decrease demand for our products and adversely impact our financial performance. For example, if the value of the U.S. dollar increases relative to foreign currencies, our products could become more costly to the international consumer and therefore less competitive in international markets, or if the value of the U.S. dollar decreases relative to the Singapore dollar or the Canadian dollar, it would become more costly in U.S. dollars for us to manufacture our products in Singapore and/or in Canada. Additionally, our expenses are generally denominated in the currencies of the countries in which our operations are located, which is primarily in the United States, with a portion of expenses incurred in Singapore and Canada where a significant portion of our manufacturing operations are located. Our results of operations and cash flows are, therefore, subject to fluctuations due to changes in foreign currency exchange rates. The volatility of exchange rates depends on many factors that we cannot forecast with reliable accuracy. We have experienced and will continue to experience fluctuations in our net income or loss as a result of transaction gains or losses related to revaluing certain current asset and current liability balances that are denominated in currencies other than the functional currency of the entities in which they are recorded. Fluctuations in currency exchange rates could have an adverse impact on our financial results in the future.

Any disruption or delay in the shipping or off-loading of our products, whether domestically or internationally, may have an adverse effect on our financial condition and results of operations.

We rely on shipping providers to deliver products to our customers globally. Labor, tariff, or World Trade Organization-related disputes, piracy, physical damage to shipping facilities or equipment caused by severe weather or terrorist incidents, congestion at shipping facilities, inadequate equipment to load, dock, and offload our products, energy-related tie-ups, or other factors could disrupt or delay shipping or off-loading of our products domestically and internationally. Such disruptions or delays may have an adverse effect on our financial condition and results of operations.

We are dependent on single and sole source suppliers for some of the components and materials used in our products, and the loss of any of these suppliers could harm our business.

We rely on single and sole source suppliers for certain components and materials used in our products. Additionally, several of our instruments are assembled at the facilities of contract manufacturers in Singapore. We do not have long term contracts with our suppliers of these components and materials or our assembly service providers. The loss of a single or sole source supplier of any of the following components and/or materials would require significant time and effort to locate and qualify an alternative source of supply, if at all:

- The IFCs used in our microfluidic systems are fabricated using a specialized polymer, and other specialized materials, that are available from a limited number of sources. In the past, we have encountered quality issues that have reduced our manufacturing yield or required the use of additional manufacturing processes.
- The electron multiplier detector included in the Hyperion/Helios systems and certain metal isotopes used with the Hyperion/Helios systems are purchased from sole source suppliers.
- The raw materials for our Delta Gene and SNP Type assays and Access Array target-specific primers are available from a limited number of sources.

Our reliance on single and sole source suppliers and assembly service providers also subjects us to other risks that could harm our business, including the following:

- we may be subject to increased component or assembly costs and
- we may not be able to obtain adequate supply or services in a timely manner or on commercially reasonable terms.

We have in the past experienced quality control and supply problems with some of our suppliers, such as manufacturing errors, and may again experience problems in the future. We may not be able to quickly establish additional or replacement suppliers, particularly for our single source components, or assembly service providers. Any interruption or delay in the supply of components or materials or assembly of our instruments, or our inability to obtain components, materials, or assembly services from alternate sources at acceptable prices in a timely manner, could impair our ability to meet the demand of our customers and cause them to cancel orders or switch to competitive products.

Our future success is dependent upon our ability to expand our customer base and introduce new applications.

Our customer base is primarily composed of academic research institutions, translational research and medicine centers, cancer centers, clinical research laboratories, biopharmaceutical, biotechnology, and plant and animal research companies, and contract research organizations that perform analyses for research and commercial purposes. Our success will depend, in part, upon our ability to increase our market share among these customers, attract additional customers outside of these markets, and market new applications to existing and new customers as we develop such applications. Attracting new customers and introducing new applications require substantial time and expense. For example, it may be difficult to identify, engage, and market to customers who are unfamiliar with the current applications of our systems. Any failure to expand our existing customer base or launch new applications would adversely affect our ability to increase our revenue.

We may not be able to develop new products or enhance the capabilities of our existing systems to keep pace with rapidly changing technology and customer requirements, which could have a material adverse effect on our business, revenue, financial condition, and operating results.

Our success depends on our ability to develop new products and applications for our technology in existing and new markets, while improving the performance and cost-effectiveness of our systems. New technologies, techniques, or products could emerge that might offer better combinations of price and performance than our current or future product lines and systems. Existing markets for our products, including high-throughput genomics, single-cell genomics and mass cytometry, as well as potential markets for our products such as high-throughput DNA sequencing and molecular applications, are characterized by rapid technological change and innovation. It is critical to our success for us to anticipate changes in technology and customer requirements and to successfully introduce new, enhanced, and competitive technology to meet our customers' and prospective customers' needs on a timely and cost-effective basis. Developing and implementing new technologies will require us to incur substantial development costs and we may not have adequate resources available to be able to successfully introduce new applications of, or enhancements to, our systems. We cannot guarantee that we will be able to maintain technological advantages over emerging technologies in the future. While we typically plan improvements to our systems, we may not be able to successfully implement these improvements. If we fail to keep pace with emerging technologies, demand for our systems will not grow and may decline, and our business, revenue, financial condition, and operating results could suffer materially. In addition, if we introduce enhanced systems but fail to manage product transitions effectively, customers may delay or forgo purchases of our systems and our operating results may be adversely affected by product obsolescence and excess inventory. Even if we successfully implement some or all of these planned improvements, we cannot guarantee that our current and potential customers will find our enhanced systems to be an attractive alternative to existing technologies, including our current products.

Our business operations depend upon the continuing efforts of our management team and other skilled and experienced personnel, and if we are unable to retain them or to recruit and train new key executives, scientists, and technical support personnel, we may be unable to achieve our goals.

Our success depends largely on the skills, experience, and performance of our management team and scientific and technical support personnel. The loss of the services of any key member of our management team or our scientific or technical support staff might significantly delay or prevent the development of our products or achievement of other business objectives by diverting management's attention to transition matters and identification of suitable replacements, if any, and could have a material adverse effect on our business. Our research and product development efforts could also be delayed or curtailed if we are unable to attract, train, and retain highly skilled employees, particularly, senior scientists and engineers. We do not maintain fixed term employment contracts or significant key person life insurance with any of our employees.

Additionally, to expand our research and product development efforts, we need to retain and recruit scientists skilled in areas such as molecular and cellular biology, assay development, and manufacturing. We also need highly trained technical support personnel with the necessary scientific background and ability to understand our systems at a technical level to effectively support potential new customers and the expanding needs of current customers. Competition for these people is intense and we may face challenges in retaining and recruiting such individuals if, for example, our stock price declines, reducing the retention value of equity awards, or our business or technology is no longer perceived as leading in our field. Because of the complex and technical nature of our systems and the dynamic market in which we compete, any failure to attract and retain a sufficient number of qualified employees could materially harm our ability to develop and commercialize our technology.

Our business growth strategy involves the potential for significant acquisitions, and our operating results and prospects could be harmed if we are unable to integrate future acquisitions successfully.

We may acquire other businesses to improve our product offerings or expand into new markets. Our future acquisition strategy will depend on our ability to identify, negotiate, complete, and integrate acquisitions and, if necessary, to obtain satisfactory debt or equity financing to fund those acquisitions. Mergers and acquisitions are inherently risky, and any transaction we complete may not be successful. Any merger or acquisition we may pursue would involve numerous risks, including but not limited to the following:

- difficulties in integrating and managing the operations, technologies, and products of the companies we acquire;
- diversion of our management's attention from normal daily operation of our business;
- our inability to maintain the key business relationships and the reputations of the businesses we acquire;
- our inability to retain key personnel of the acquired company;
- uncertainty of entry into markets in which we have limited or no prior experience and in which competitors have stronger market positions;
- our dependence on unfamiliar affiliates and customers of the companies we acquire;
- insufficient revenue to offset our increased expenses associated with acquisitions;
- our responsibility for the liabilities of the businesses we acquire, including those which we may not anticipate; and
- our inability to maintain internal standards, controls, procedures, and policies.

We may be unable to secure the equity or debt funding necessary to finance future acquisitions on terms that are acceptable to us. If we finance acquisitions by issuing equity or convertible debt securities, our existing stockholders will likely experience dilution, and if we finance future acquisitions with debt funding, we will incur interest expense and may have to comply with financial covenants and secure that debt obligation with our assets.

Security breaches, loss of data, cyberattacks, and other information technology failures could disrupt our operations, damage our reputation, and adversely affect our business, operations, and financial results.

We are dependent upon our data and information technology systems for the effective operation of our business and for the secure maintenance and storage of confidential data relating to our business and third-party businesses. Our information technology systems may be damaged, disrupted or shut down due to attacks by experienced programmers or hackers who may be able to penetrate our security controls and deploy computer viruses, cyberattacks, phishing schemes, or other malicious software programs, or due to employee error or malfeasance, power outages, hardware failures, telecommunication or utility failures, catastrophes or other unforeseen events, and our system redundancy and other disaster recovery planning may be ineffective or inadequate in preventing or responding to any of these circumstances. Any such compromise of our information technology systems could result in the unauthorized publication of our confidential business or proprietary information and unauthorized release of customer, supplier or employee data, any of which could expose us to a risk of legal claims or proceedings, liability under privacy or other laws, disruption of our operations and damage to our reputation, which could divert our management's attention from the operation of our business and materially and adversely affect our business, revenues and competitive position. In addition, our liability insurance may not be sufficient in type or amount to cover us against claims related to security breaches, cyberattacks and other related breaches. The cost and operational consequences of implementing further data protection measures, either as a response to specific breaches or as a result of evolving risks, could be significant. In addition, our inability to use or access our information systems at critical points in time could adversely affect the timely and efficient operation of our business. Any delayed sales, significant costs or lost customers resulting from these technology failures could adversely affect our business, operations, and financial results.

We have implemented security controls to protect our information technology infrastructure but, despite our efforts, we are not fully insulated from technology disruptions that could adversely impact us. For example, in March 2019, we experienced a ransomware attack that infiltrated and encrypted certain of our information technology systems, including systems containing critical business data. Immediately following the attack, actions were taken to recover the compromised systems and we believe we were able to restore their operation without significant loss of business data. Based on the nature of the attack and its impact on our systems, we do not believe confidential data was lost or disclosed. If, however, confidential data is later determined to have been released in the course of this or any future event, it is possible that we could be the subject of actions by governmental authorities or claims from persons alleging they suffered damages from such a release. Although we believe we have contained the disruption from the March 2019 attack, we anticipate additional work and expense in the future as we continue to enhance our security processes and initiatives in response to ever-evolving information security threats.

In addition to risks affecting our own systems, we could also be negatively impacted by a data breach or cyber incident happening to a third party's network and affecting us. Third parties with which we conduct business have access to certain portions of our sensitive data, including information pertaining to our customers and employees. In the event that these third parties do not adequately safeguard our data, security breaches could result and negatively impact our business, operations, and financial results.

Our efficiency and cost-savings initiatives could be disruptive to our operations and adversely affect our results of operations and financial condition, and we may not realize some or all of the anticipated benefits of these initiatives in the time frame anticipated or at all.

Since 2017, we have implemented efficiency and cost-savings initiatives intended to stabilize our business operations and return to growth. These efficiency initiatives have included targeted workforce reductions, optimizing our facilities, and reducing excess space. Further actions such as these may be required on an ongoing basis to optimize our organization. For example, we may need to decrease or defer capital expenditures and development activities or implement further operating expense reduction measures. The implementation of these further efficiency and cost-savings initiatives could impair our ability to invest in developing, marketing and selling new and existing products, be disruptive to our operations, make it difficult to attract or retain employees, result in higher than anticipated charges, divert the attention of management, result in a loss of accumulated knowledge, impact our customer and supplier relationships, and otherwise adversely affect our results of operations and financial condition. In addition, our ability to complete our efficiency and cost-savings initiatives and achieve the anticipated benefits within the expected time frame is subject to estimates and assumptions and may vary materially from our expectations, including as a result of factors that are beyond our control. Furthermore, our efforts to grow our business and become profitable may not be successful.

To use our products, our Biomark, EP1, Helios/CyTOF 2, and Hyperion systems in particular, customers typically need to purchase specialized reagents. Any interruption in the availability of these reagents for use in our products could limit our ability to market our products.

Our products, our Biomark, EP1, Helios, and Hyperion systems in particular, must be used in conjunction with one or more reagents designed to produce or facilitate the particular biological or chemical reaction desired by the user. Many of these reagents are highly specialized and available to the user only from a single supplier or a limited number of suppliers. Although we sell reagents for use with certain of our products, our customers may purchase these reagents directly from third-party suppliers, and we have no control over the supply of those materials. In addition, our products are designed to work with these reagents as they are currently formulated. We have no control over the formulation of reagents sold by third-party suppliers, and the performance of our products might be adversely affected if the formulation of these reagents is changed. If one or more of these reagents were to become unavailable or were reformulated, our ability to market and sell our products could be materially and adversely affected.

In addition, the use of a reagent for a particular process may be covered by one or more patents relating to the reagent itself, the use of the reagent for the particular process, the performance of that process, or the equipment required to perform the process. Typically, reagent suppliers, who are either the patent holders or their authorized licensees, sell the reagents along with a license or covenant not to sue with respect to such patents. The license accompanying the sale of a reagent often purports to restrict the purposes for which the reagent may be used. If a patent holder or authorized licensee were to assert against us or our customers that the license or covenant relating to a reagent precluded its use with our systems, our ability to sell and market our products could be materially and adversely affected. For example, our Biomark system involves real-time quantitative polymerase chain reaction (qPCR) technology. Leading suppliers of reagents for real-time qPCR reactions include Life Technologies Corporation (now part of Thermo) and Roche Diagnostics Corporation, who are our direct competitors, and their licensees. These real-time qPCR reagents are typically sold pursuant to limited licenses or covenants not to sue with respect to patents held by these companies. We do not have any contractual supply agreements for these real-time qPCR reagents, and we cannot assure you that these reagents will continue to be available to our customers for use with our systems, or that these patent holders will not seek to enforce their patents against us, our customers, or suppliers.

If we elect to label and promote any of our products as medical devices, we would be required to obtain prior approval or clearance by the FDA, which would take significant time and expense and could fail to result in FDA clearance or approval for the intended uses we believe are commercially attractive.

Our products are currently labeled, promoted and sold to academic research institutions, translational research and medicine centers, cancer centers, clinical research laboratories, contract research organizations, and biopharmaceutical, biotechnology, and plant and animal research companies as RUO, and are not designed, or intended to be used, for clinical diagnostic tests or as medical devices as currently marketed. If we elect to label and market our products for use as, or in the performance of, clinical diagnostics in the United States, thereby subjecting them to FDA regulation as medical devices, we would be required to obtain premarket 510(k) clearance or premarket approval from the FDA, unless an exception applies.

We may in the future register with the FDA as a medical device manufacturer and list some of our products with the FDA pursuant to an FDA Class I listing for general purpose laboratory equipment. While this regulatory classification is exempt from certain FDA requirements, such as the need to submit a premarket notification commonly known as a 510(k), and some of the requirements of the FDA's Quality System Regulations (QSRs), we would be subject to ongoing FDA "general controls," which include compliance with FDA regulations for labeling, inspections by the FDA, complaint evaluation, corrections and removals reporting, promotional restrictions, reporting adverse events or malfunctions for our products, and general prohibitions against misbranding and adulteration.

In addition, we may in the future submit 510(k) premarket notifications to the FDA to obtain FDA clearance of certain of our products on a selected basis. It is possible, in the event we elect to submit 510(k) applications for certain of our products, that the FDA would take the position that a more burdensome premarket application, such as a premarket approval application or a de novo application is required for some of our products. If such applications were required, greater time and investment would be required to obtain FDA approval. Even if the FDA agreed that a 510(k) was appropriate, FDA clearance can be expensive and time consuming. It generally takes a significant amount of time to prepare a 510(k), including conducting appropriate testing on our products, and several months to years for the FDA to review a submission. Notwithstanding the effort and expense, FDA clearance or approval could be denied for some or all of our products. Even if we were to seek and obtain regulatory approval or clearance, it may not be for the intended uses we believe are important or commercially attractive.

If we sought and received regulatory clearance or approval for certain of our products, we would be subject to ongoing FDA obligations and continued regulatory oversight and review, including the general controls listed above and the FDA's QSRs for our development and manufacturing operations. In addition, we would be required to obtain a new 510(k) clearance before we could introduce subsequent modifications or improvements to such products. We could also be subject to additional FDA post-marketing obligations for such products, any or all of which would increase our costs and divert resources away from other projects. If we sought and received regulatory clearance or approval and are not able to maintain regulatory compliance with applicable laws, we could be prohibited from marketing our products for use as, or in the performance of, clinical diagnostics and/or could be subject to enforcement actions, including warning letters and adverse publicity, fines, injunctions, and civil penalties; recall or seizure of products; operating restrictions; and criminal prosecution.

In addition, we could decide to seek regulatory clearance or approval for certain of our products in countries outside of the United States. Sales of such products outside the United States will likely be subject to foreign regulatory requirements, which can vary greatly from country to country. As a result, the time required to obtain clearances or approvals outside the United States may differ from that required to obtain FDA clearance or approval and we may not be able to obtain foreign regulatory approvals on a timely basis or at all. In Europe, we would need to comply with the new Medical Device Regulation 2017/745 and In Vitro Diagnostic Regulation 2017/746, which became effective May 26, 2017, with application dates of May 26, 2020 and May 26, 2022 respectively. This will increase the difficulty of regulatory approvals in Europe in the future. In addition, the FDA regulates exports of medical devices. Failure to comply with these regulatory requirements or obtain and maintain required approvals, clearances and certifications could impair our ability to commercialize our products for diagnostic use outside of the United States.

Our products could become subject to regulation as medical devices by the FDA or other regulatory agencies even if we do not elect to seek regulatory clearance or approval to market our products for diagnostic purposes, which would adversely impact our ability to market and sell our products and harm our business.

As products that are currently labeled, promoted and intended as RUO, our products are not currently subject to regulation as medical devices by the FDA or comparable agencies of other countries. However, the FDA or comparable agencies of other countries could disagree with our conclusion that our products are currently intended for research use only or deem our current sales, marketing and promotional efforts as being inconsistent with research use only products. For example, our customers may independently elect to use our research use only labeled products in their own laboratory developed tests (LDTs) for clinical diagnostic use. The FDA has historically exercised enforcement discretion in not enforcing the medical device regulations against laboratories offering LDTs. However, on October 3, 2014, the FDA issued two draft guidance documents that set forth the FDA's proposed risk-based framework for regulating LDTs, which are designed, manufactured, and used within a single laboratory. The draft guidance documents provide the anticipated details through which the FDA would propose to establish an LDT oversight framework, including premarket review for higher-risk LDTs, such as those that have the same intended use as FDA-approved or cleared companion diagnostic tests currently on the market. In January 2017, the FDA announced that it would not issue final guidance on the oversight of LDTs and LDT manufacturers, but would seek further public discussion on an appropriate oversight approach, and give Congress an opportunity to develop a legislative solution. More recently, the FDA has issued warning letters to certain genomics labs for illegally marketing genetic tests that claim to predict patients' responses to specific medications, noting that the FDA has not created a legal "carve-out" for LDTs and retains discretion to take action when appropriate, such as when certain genomic tests raise significant public health concerns. As manufacturers develop more complex genetic tests and diagnostic software, the FDA may increase its regulation of LDTs. Any future legislative or administrative rule making or oversight of LDTs and LDT manufacturers, if and when finalized, may impact the sales of our products and how customers use our products, and may require us to change our business model in order to maintain compliance with these laws. We cannot predict how these various efforts will be resolved, how Congress or the FDA will regulate LDTs in the future, or how that regulatory system will impact our business.

Additionally, on November 25, 2013, the FDA issued Final Guidance "Distribution of In Vitro Diagnostic Products Labeled for Research Use Only." The guidance emphasizes that the FDA will review the totality of the circumstances when it comes to evaluating whether equipment and testing components are properly labeled as RUO. The final guidance states that merely including a labeling statement that the product is for research purposes only will not necessarily render the device exempt from the FDA's clearance, approval, and other regulatory requirements if the circumstances surrounding the distribution, marketing and promotional practices indicate that the manufacturer knows its products are, or intends for its products to be, used for clinical diagnostic purposes. These circumstances may include written or verbal sales and marketing claims or links to articles regarding a product's performance in clinical applications and a manufacturer's provision of technical support for clinical applications.

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

Compliance or the failure to comply with current and future regulations affecting our products and business operations worldwide, such as environmental regulations enacted in the European Union, could cause us significant expense and adversely impact our business.

We are subject to many federal, state, local, and foreign regulations relating to various aspects of our business operations. Governmental entities at all levels are continuously enacting new regulations, and it is difficult to identify all applicable regulations and anticipate how such regulations will be implemented and enforced. We continue to evaluate the necessary steps for compliance with applicable regulations. To comply with applicable regulations, we have and will continue to incur significant expense and allocate valuable internal resources to manage compliance-related issues. In addition, such regulations could restrict our ability to expand or equip our facilities, or could require us to acquire costly equipment or to incur other significant expenses to comply with the regulations. For example, the Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Directive (RoHS) and the Waste Electrical and Electronic Equipment Directive (WEEE), both enacted in the European Union, regulate the use of certain hazardous substances in, and require the collection, reuse, and recycling of waste from, products we manufacture. Certain of our products sold in these countries are subject to WEEE and RoHS. These and similar regulations that have been or are in the process of being enacted in other countries may require us to redesign our products, use different types of materials in certain components, or source alternative components to ensure compliance with applicable standards, and may reduce the availability of parts and components used in our products by negatively impacting our suppliers' ability to source parts and components in a timely and cost-effective manner.

Any such redesigns, required use of alternative materials, or limited availability of parts and components used in our products may detrimentally impact the performance of our products, add greater testing lead times for product introductions, reduce our product margins, or limit the markets for our products, and if we fail to comply with any present and future regulations, we could be subject to future fines, penalties, and restrictions, such as the suspension of manufacturing of our products or a prohibition on the sale of products we manufacture. Any of the foregoing could adversely affect our business, financial condition, or results of operations.

If we fail to maintain effective internal control over financial reporting in the future, the accuracy and timing of our financial reporting may be impaired, which could adversely affect our business and our stock price.

The Sarbanes-Oxley Act requires, among other things, that we maintain effective internal control over financial reporting and disclosure controls and procedures. In particular, we must perform system and process evaluation and testing of our internal control over financial reporting to allow management to report on the effectiveness of our internal control over financial reporting, as required by Section 404 of the Sarbanes-Oxley Act. Our testing may reveal deficiencies in our internal control over financial reporting that are deemed to be material weaknesses.

Our compliance with Section 404 requires that we incur substantial accounting expense and expend significant management time on compliance-related issues. We currently do not have an internal audit group, and we continue to evaluate our need for additional accounting and financial staff with appropriate public company experience and technical accounting knowledge. Moreover, if we do not comply with the requirements of Section 404, or if we or our independent registered public accounting firm identify deficiencies in our internal control over financial reporting that are deemed to be material weaknesses, the market price of our stock could decline and we could be subject to sanctions or investigations by the Nasdaq Global Select Market (Nasdaq), the SEC, or other regulatory authorities, which would require additional financial and management resources.

Impairment of our goodwill or other intangible assets could materially and adversely affect our business, operating results, and financial condition.

As of December 31, 2019, we had approximately $153.2 million of goodwill and net intangible assets, including approximately $104.1 million of goodwill and $49.1 million of net intangible assets. These assets represent a significant portion of the assets recorded on our consolidated balance sheet and relate primarily to our acquisition of DVS Sciences, Inc. (DVS) in February 2014. In addition, if in the future we acquire additional businesses, technologies, or other intangible assets, a substantial portion of the value of such assets may be recorded as goodwill or intangible assets. In the fourth quarter of 2019, we concluded that certain of our patents and licenses were impaired and reduced the applicable carrying value to zero, recognizing a charge of $0.4 million, which is reflected in accumulated amortization.

The carrying amounts of goodwill and intangible assets are affected whenever events or changes in circumstances indicate that their carrying amounts may not be recoverable. We review goodwill and indefinite lived intangible assets for impairment at least annually and more frequently under certain circumstances. Other intangible assets that are deemed to have finite useful lives will continue to be amortized over their useful lives but must be reviewed for impairment when events or changes in circumstances indicate that the carrying amount of these assets may not be recoverable. Events or changes in circumstances that could affect the likelihood that we will be required to recognize an impairment charge include declines in our stock price or market capitalization, declines in our market share or revenues, an increase in our losses, rapid changes in technology, failure to achieve the benefits of capacity increases and utilization, significant litigation arising out of an acquisition, or other matters. In particular, these or other adverse events or changes in circumstances may affect the estimated undiscounted future operating cash flows expected to be derived from our goodwill and intangible assets. Any impairment charges could have a material adverse effect on our operating results and net asset value in the quarter in which we recognize the impairment charge. We cannot provide assurances that we will not in the future be required to recognize impairment charges.

Our future capital needs are uncertain and we may need to raise additional funds in the future, which may cause dilution to stockholders or may be upon terms that are not favorable to us.

We believe that our existing cash and cash equivalents and availability under our $15.0 million revolving senior credit facility (Revolving Credit Facility) will be sufficient to meet our anticipated cash requirements for at least the next 18 months. We have continued to experience losses and, if that trend continues, we may need to seek additional sources of financing. In addition, we may need to raise substantial additional capital for various purposes, including:

- expanding the commercialization of our products;
- funding our operations;
- furthering our research and development; and
- acquiring other businesses or assets and licensing technologies.

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

- market acceptance of our products;
- the cost of our research and development activities;
- the cost of filing and prosecuting patent applications;
- the cost of defending any litigation including intellectual property, employment, contractual or other litigation;
- the cost and timing of regulatory clearances or approvals, if any;
- the cost and timing of establishing additional sales, marketing, and distribution capabilities;
- the cost and timing of establishing additional technical support capabilities;
- fluctuations in cash demands (e.g., due to interest or principal payments or payouts under existing cash compensation plans);
- variability in sales and timing of related cash collections;
- the effectiveness of our recent efficiency and cost-savings initiatives;
- the effect of competing technological and market developments; and
- the extent to which we acquire or invest in businesses, products, and technologies, although we currently have no commitments or agreements relating to any of these types of transactions.

To the extent we draw on our Revolving Credit Facility or otherwise incur additional indebtedness, the risks described above could increase. Further, if we increase our indebtedness, our actual cash requirements in the future may be greater than expected. Our cash flow from operations may not be sufficient to repay all of the outstanding debt as it becomes due, and 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 securities, our stockholders may experience dilution. Debt financing in addition to the Revolving Credit Facility, if available, may involve covenants restricting our operations or our ability to incur additional debt. Any additional debt or equity financing that we raise 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 unable to raise adequate funds, we may have to liquidate some or all of our assets, delay development or commercialization of our products, or license to third parties the rights to commercialize products or technologies that we would otherwise seek to commercialize. We also may have to reduce marketing, customer support, research and development, or other resources devoted to our products, or cease operations. Any of these factors could harm our operating results.

If we fail to comply with the covenants and other obligations under our Revolving Credit Facility, the lenders may be able to accelerate amounts owed under the facilities and may foreclose upon the assets securing our obligations.

In August 2018, we entered into the Revolving Credit Facility, which provides for secured revolving loans in an aggregate amount of up to $15.0 million. The Revolving Credit Facility is secured by substantially all of our assets, other than intellectual property. The Revolving Credit Facility contains customary affirmative and negative covenants which, unless waived by the bank, limit our ability to, among other things, incur additional indebtedness, grant liens, make investments, repurchase stock, pay dividends, transfer assets, enter into affiliate transactions, undergo a change of control, or engage in merger and acquisition activity, including merging or consolidating with a third party. If we fail to comply with the covenants and our other obligations under the Revolving Credit Facility, the lenders would be able to accelerate the required repayment of amounts due under the 2018 Credit Agreement and, if they are not repaid, could foreclose upon the assets securing our obligations under the Revolving Credit Facility.

We are subject to risks related to taxation in multiple jurisdictions and if taxing authorities disagree with our interpretations of existing tax laws or regulations, our effective income tax rate could be adversely affected and we could have additional tax liability.

We are subject to income taxes in both the United States and certain foreign jurisdictions. Significant judgments based on interpretations of existing tax laws or regulations are required in determining the provision for income taxes. For example, we have made certain interpretations of existing tax laws or regulations based upon the operations of our business internationally and we have implemented intercompany agreements based upon these interpretations and related transfer pricing analyses. If the U.S. Internal Revenue Service or other taxing authorities disagree with the positions, our effective income tax rate could be adversely affected and we could have additional tax liability, including interest and penalties. From time to time, we may review our corporate structure and tax positions in the various international jurisdictions in which we operate and such review may result in changes to how we structure our international business operations, which may adversely impact our effective income tax rate. Our effective income tax rate could also be adversely affected by changes in the mix of earnings in tax jurisdictions with different statutory tax rates, changes in the valuation of deferred tax assets and liabilities, changes in existing tax laws or tax rates, changes in the level of non-deductible expenses (including share-based compensation), changes in our future levels of research and development spending, mergers and acquisitions, or the result of examinations by various tax authorities. Payment of additional amounts as a result of changes in applicable tax law or upon final adjudication of any disputes could have a material impact on our results of operations and financial position.

Our ability to use net operating loss carryforwards to offset future taxable income for U.S. federal income tax purposes and other tax benefits may be limited.

Section 382 of the Internal Revenue Code of 1986, as amended (the Code), imposes an annual limitation on the amount of taxable income that may be offset by net operating loss carryforwards (NOLs) if a corporation experiences an “ownership change.” As provided in Section 382 of the Code, an “ownership change” occurs when a company’s “five-percent shareholders” collectively increase their ownership in the company by more than 50 percentage points (by value) over a rolling three-year period. Various states also have limitations on the use of state NOLs following an ownership change.

Future changes in our stock ownership, some of which are outside our control, could result in an ownership change under Section 382 of the Code. If we experience an ownership change, our ability to use our NOLs or other tax benefits could be substantially limited, which could significantly impair their value. There is no assurance that we will be able to fully utilize our NOLs or other tax benefits, which could adversely impact our results of operations.

We believe that these tax benefits are a valuable asset for us and we monitor our stock ownership to determine whether our NOLs are at material risk of limitation based on an ownership change pursuant to Section 382. If our board of directors determines a potential risk exists that our NOLs could be limited, it could elect to adopt a tax benefit preservation plan in an effort to protect our tax benefits. Adoption of a tax benefit preservation plan could make it more difficult for a third party to acquire, or could discourage a third party from acquiring, us or a large block of our common stock.

Adverse conditions in the global economy and disruption of financial markets may significantly harm our revenue, profitability, and results of operations.

The global credit and financial markets have in recent years experienced volatility and disruptions, including diminished liquidity and credit availability, increased concerns about inflation and deflation, and the downgrade of U.S. debt and exposure risks on other sovereign debts, decreased consumer confidence, lower economic growth, volatile energy costs, increased unemployment rates, and uncertainty about economic stability. In addition, certain geopolitical events, including the United States government’s adoption and expansion of trade restrictions and the United Kingdom’s withdrawal from the European

Union, have caused significant economic, market, political and regulatory uncertainty in some of our markets. Volatility and disruption of financial markets could limit our customers' ability to obtain adequate financing or credit to purchase and pay for our products in a timely manner or to maintain operations, which could result in a decrease in sales volume that could harm our results of operations. General concerns about the fundamental soundness of domestic and international economies may also cause our customers to reduce their purchases. Changes in governmental banking, monetary, and fiscal policies to address liquidity and increase credit availability may not be effective. Significant government investment and allocation of resources to assist the economic recovery of sectors which do not include our customers may reduce the resources available for government grants and related funding for life science, plant and animal research, and clinical research and development. Continuation or further deterioration of these financial and macroeconomic conditions could significantly harm our sales, profitability, and results of operations.

If we are unable to expand our direct sales and marketing force or distribution capabilities to adequately address our customers' needs, our business may be adversely affected.

We may not be able to market, sell, and, distribute our products effectively enough to support our planned growth. We sell our products primarily through our own sales force and through distributors in certain territories. Our future sales will depend in large part on our ability to continue to develop and substantially expand our direct sales force and to increase the scope of our marketing efforts. Our products are technically complex and used for highly specialized applications. As a result, we believe it is necessary to continue to develop a direct sales force that includes people with specific scientific backgrounds and expertise, and a marketing group with technical sophistication. Competition for such employees is intense. In addition, we have experienced significant changes in our sales organization in recent quarters due to reorganizations and changes in leadership. We may not be able to attract and retain personnel or be able to build an efficient and effective sales and marketing force, which would negatively impact sales of our products and reduce our revenue and profitability.

In addition, we may continue to enlist one or more sales representatives and distributors to assist with sales, distribution, and customer support globally or in certain regions of the world. If we do seek to enter into such arrangements, we may not be successful in attracting desirable sales representatives and distributors, or we may not be able to enter into such arrangements on favorable terms. If our sales and marketing efforts, or those of any third-party sales representatives and distributors, are not successful, our technologies and products may not gain market acceptance, which would materially and adversely impact our business operations.

If we seek to implement a company-wide enterprise resource planning (ERP) system, such implementation could adversely affect our business and results of operations or the effectiveness of internal control over financial reporting.

We have considered implementing a company-wide ERP system to handle the business and financial processes within our operations and corporate functions. ERP implementations are complex and time-consuming projects that involve substantial expenditures on system software and implementation activities that can continue for several years. ERP implementations also require transformation of business and financial processes in order to reap the benefits of the ERP system. If we decide to implement a company-wide ERP system, our business and results of operations could be adversely affected if we experience operating problems and/or cost overruns during the ERP implementation process, or if the ERP system and the associated process changes do not give rise to the benefits that we expect. If we do not effectively implement the ERP system as planned or if the system does not operate as intended, our business, results of operations, and internal controls over financial reporting could be adversely affected.

Changes in accounting principles, or interpretations thereof, could have a significant impact on our financial position and results of operations.

We prepare our consolidated financial statements in accordance with accounting principles generally accepted in the United States of America (U.S. GAAP). These principles are subject to interpretation by the SEC and various bodies formed to interpret and create appropriate accounting principles. A change in these principles can have a significant effect on our reported results and may even retroactively affect previously reported transactions. Additionally, the adoption of new or revised accounting principles may require that we make significant changes to our systems, processes and controls.

For example, the U.S.-based Financial Accounting Standards Board (FASB) is currently working together with the International Accounting Standards Board (IASB), on several projects to further align accounting principles and facilitate more comparable financial reporting between companies who are required to follow U.S. GAAP under SEC regulations and those who are required to follow International Financial Reporting Standards outside of the United States. These efforts by the FASB and IASB may result in different accounting principles under U.S. GAAP that may result in materially different financial results for us in areas including, but not limited to, principles for recognizing revenue and lease accounting. Additionally, significant changes to U.S. GAAP resulting from the FASB's and IASB's efforts may require that we change how we process, analyze and report financial information and that we change financial reporting controls. Additionally, the FASB issued new guidance (ASU 2014-09) *Revenue from Contracts with Customers (Topic 606)* which supersedes nearly all existing U.S. GAAP revenue recognition guidance. The new guidance was effective for our fiscal year 2018. We adopted ASU 2014-09 in the first quarter of 2018 using the modified retrospective method. Under the modified retrospective method, periods prior to the adoption of ASU 2014-09 are not restated and the cumulative effect of initially applying the new standard is reflected in the opening balance of accumulated deficit as of January 1, 2018. To date, the adoption has not had a material impact on our consolidated financial statements. Additional disclosures are required for significant differences between the reported results under the new standard and those that would have been reported under the legacy standard, which required us to make certain changes to our business processes and controls to support revenue recognition and disclosure under the new standard.

The FASB also issued Accounting Standards Update (ASU) 2016-02, *Leases (Topic 842)* (ASU 2016-02). The core principle is that lessees should recognize the assets and liabilities arising from leases on the balance sheet. Under the new standard, lessees will be required to recognize lease assets and liabilities for all leases, with certain exceptions, on their balance sheets. We adopted ASU 2016-02 as of January 1, 2019. The adoption of this standard had a material impact on our consolidated financial statements. We continue to identify the appropriate changes to our business processes, systems, and controls to support the new lease standard and the required disclosures under the new standard.

It is not clear if or when potential changes in accounting principles may become effective, whether we have the proper systems and controls in place to accommodate such changes and the impact that any such changes may have on our financial position and results of operations.

We have a significant amount of outstanding indebtedness, and our financial condition and results of operations could be adversely affected if we do not efficiently manage our liabilities.

We have significant outstanding convertible debt. As of December 31, 2019, we had outstanding $1.1 million aggregate principal amount of our 2.75% Senior Convertible Notes due 2034 (2014 Notes) and $55.0 million aggregate principal amount of our 5.25% convertible senior notes due 2024 (2019 Notes). The 2014 Notes will mature on February 1, 2034, unless earlier converted, redeemed, or repurchased in accordance with the terms of the 2014 Notes. Holders of the 2014 Notes may require us to repurchase all or a portion of their 2014 Notes on each of February 6, 2021, February 6, 2024, and February 6, 2029 at a repurchase price in cash equal to 100% of the principal amount of the Notes plus accrued and unpaid interest. The 2019 Notes will mature on December 1, 2024, unless earlier converted, or repurchased in accordance with the terms of the 2019 Notes. If we undergo a fundamental change (as defined in the terms of the indenture governing either the 2014 Notes or the 2019 Notes (collectively, the Convertible Notes)), holders of the applicable series of Convertible Notes may require us to repurchase such Convertible Notes in whole or in part for cash at a repurchase price equal to 100% of the principal amount of the applicable series of Convertible Notes plus accrued and unpaid interest. If we refinance the debt owed under the 2014 Notes or 2019 Notes, we may issue additional convertible notes or other debt, which could include additional company obligations and represent more dilution to existing stockholders and noteholders.

This significant amount of debt has important risks to us and our investors, including:

- requiring a portion of our cash flow from operations to make interest payments on this debt;
- increasing our vulnerability to general adverse economic and industry conditions;
- reducing the cash flow available to fund capital expenditures and other corporate purposes and to grow our business;
- limiting our flexibility in planning for, or reacting to, changes in our business and the industry; and
- limiting our ability to borrow additional funds as needed or take advantage of business opportunities as they arise.

In addition, to the extent we draw on our Revolving Credit Facility or otherwise incur additional indebtedness, the risks described above could increase. Further, if we increase our indebtedness, our actual cash requirements in the future may be greater than expected. Our cash flow from operations may not be sufficient to repay all of the outstanding debt as it becomes due, and we may not be able to borrow money, sell assets or otherwise raise funds on acceptable terms, or at all, to refinance our debt.

Risks Related to Intellectual Property

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

Our commercial success depends in part on our ability to protect our intellectual property and proprietary technologies. We rely on patent protection, where appropriate and available, as well as a combination of copyright, trade secret, and trademark laws, and nondisclosure, confidentiality, and other contractual restrictions to protect our proprietary technology. However, these legal means afford only limited protection and may not adequately protect our rights or permit us to gain or keep any competitive advantage. We apply for patents covering our products and technologies and uses thereof, as we deem appropriate. However, we may fail to apply for patents on important products and technologies in a timely fashion or at all. Our pending U.S. and foreign patent applications may not issue as patents or may not issue in a form that will be sufficient to protect our proprietary technology and gain or keep our competitive advantage. Any patents we have obtained or do obtain may be subject to re-examination, reissue, opposition, or other administrative proceeding, or may be challenged in litigation, and such challenges could result in a determination that the patent is invalid or unenforceable. In addition, competitors may be able to design alternative methods or devices that avoid infringement of our patents. Both the patent application process and the process of managing patent disputes can be time consuming and expensive.

Furthermore, the laws of some foreign countries may not protect our intellectual property rights to the same extent as do the laws of the United States, and many companies have encountered significant problems in protecting and defending such rights in foreign jurisdictions. Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial cost and divert our efforts and attention from other aspects of our business. Changes in either the patent laws or in interpretations of patent laws in the United States or other countries may diminish the value of our intellectual property. We cannot predict the breadth of claims that may be allowed or enforced in our patents or in third-party patents. For example:

- we might not have been the first to make the inventions covered by each of our pending patent applications;
- we might not have been the first to file patent applications for these inventions;
- the patents of others may have an adverse effect on our business; and
- others may independently develop similar or alternative products and technologies or duplicate any of our products and technologies.

To the extent our intellectual property, including licensed intellectual property, offers inadequate protection, or is found to be invalid or unenforceable, our competitive position and our business could be adversely affected.

We may be involved in lawsuits to protect or enforce our patents and proprietary rights, to determine the scope, coverage and validity of others' proprietary rights, or to defend against third party claims of intellectual property infringement, any of which could be time-intensive and costly and may adversely impact our business or stock price.

Litigation may be necessary for us to enforce our patent and proprietary rights, determine the scope, coverage, and validity of others' proprietary rights, and/or defend against third party claims of intellectual property infringement against us as well as against our suppliers, distributors, customers, and other entities with whom we do business. Litigation could result in substantial legal fees and could adversely affect the scope of our patent protection. The outcome of any litigation or other proceeding is inherently uncertain and might not be favorable to us, and we might not be able to obtain licenses to technology that we require. Even if such licenses are obtainable, they may not be available at a reasonable cost. We could therefore incur substantial costs related to royalty payments for licenses obtained from third parties, which could negatively affect our product margins or financial position. Further, we could encounter delays in product introductions, or interruptions in product sales, as we develop alternative methods or products.

As we move into new markets and applications for our products, incumbent participants in such markets may assert their patents and other proprietary rights against us as a means of impeding our entry into such markets or as a means to extract substantial license and royalty payments from us. Our commercial success may depend in part on our non-infringement of the patents or proprietary rights of third parties. Numerous significant intellectual property issues have been litigated, and will likely continue to be litigated, between existing and new participants in our existing and targeted markets. For example, some of our products provide for the testing and analysis of genetic material, and patent rights relating to genetic materials remain a developing area of patent law. A recent U.S. Supreme Court decision held, among other things, that claims to isolated genomic DNA occurring in nature are not patent eligible, while claims relating to synthetic DNA may be patent eligible. We expect the ruling will result in additional litigation in our industry. In addition, third parties may assert that we are employing their proprietary technology without authorization, and if they are successful in making such claims, we may be forced to enter into license agreements, pay additional royalties or license fees, or enter into settlements that include monetary obligations or restrictions on our business.

Our customers have been sued for various claims of intellectual property infringement in the past, and we expect that our customers will be involved in additional litigation in the future. In particular, our customers may become subject to lawsuits claiming that their use of our products infringes third-party patent rights, and we could become subject to claims that we contributed to or induced our customer's infringement. In addition, our agreements with some of our suppliers, distributors, customers, and other entities with whom we do business may require us to defend or indemnify these parties to the extent they become involved in infringement claims against us, including the claims described above. We could also voluntarily agree to defend or indemnify third parties in instances where we are not obligated to do so if we determine it would be important to our business relationships. If we are required or agree to defend or indemnify any of these third parties in connection with any infringement claims, we could incur significant costs and expenses that could adversely affect our business, operating results, or financial condition.

We may be subject to damages resulting from claims that we or our employees have wrongfully used or disclosed alleged trade secrets of our employees' former employers or other institutions or third parties with whom such employees may have been previously affiliated.

Many of our employees were previously employed at universities or other life science or plant and animal research companies, including our competitors or potential competitors. In the future, we may become subject to claims that our employees, or we, have inadvertently or otherwise used or disclosed trade secrets or other proprietary information of their former employers or other third parties or institutions with whom our employees may have been previously affiliated. Litigation may be necessary to defend against these claims. For example, we were a defendant in litigation brought against us and one of our non-executive employees by Thermo alleging, among other claims, misappropriation of proprietary information and breach of contractual and fiduciary obligations. While we resolved our dispute with Thermo in July 2017, if we fail in defending against similar claims brought in the future we could be subject to injunctive relief against us. A loss of key research personnel work product could hamper or prevent our ability to commercialize certain potential products or a loss of or inability to hire key marketing, sales or research and development personnel could adversely affect our future product development, sales and revenues, any of which could severely harm our business. Even if we are successful in defending against any similar claims brought in the future, litigation could result in substantial costs and be a distraction to management.

We depend on certain technologies that are licensed to us. We do not control these technologies and any loss of our rights to them could prevent us from selling our products, which would have an adverse effect on our business.

We rely on licenses in order to be able to use various proprietary technologies that are material to our business, including our core IFC, multi-layer soft lithography, and mass cytometry technologies. In some cases, we do not control the prosecution, maintenance, or filing of the patents to which we hold licenses, or the enforcement of these patents against third parties. Additionally, our business and product development plans anticipate and may substantially depend on future in-license agreements with additional third parties, some of which are currently in the early discussion phase. For example, Fluidigm Canada Inc., or Fluidigm Canada, an Ontario corporation and wholly-owned subsidiary of Fluidigm Sciences, was party to an interim license agreement, now expired, with Nodality, Inc., or Nodality, under which Nodality granted Fluidigm Canada a worldwide, non-exclusive, research use only, royalty bearing license to certain cytometric reagents, instruments, and other products. While we were able to secure a license under a new license agreement with Nodality, we cannot provide assurances that we will always be able to obtain suitable license rights to technologies or intellectual property of other third parties on acceptable terms, if at all.

In-licensed intellectual property rights that are fundamental to the business being operated present numerous risks and limitations. For example, all or a portion of the license rights granted may be limited for research use only, and in the event we attempt to expand into diagnostic applications, we would be required to negotiate additional rights, which may not be available to us on commercially reasonable terms, if at all.

Our rights to use the technology we license are also subject to the negotiation and continuation of those licenses. Certain of our licenses contain provisions that allow the licensor to terminate the license upon specific conditions. Our rights under the licenses are subject to our continued compliance with the terms of the license, including the payment of royalties due under the license. Because of the complexity of our products and the patents we have licensed, determining the scope of the license and related royalty obligation can be difficult and can lead to disputes between us and the licensor. An unfavorable resolution of such a dispute could lead to an increase in the royalties payable pursuant to the license. If a licensor believed we were not paying the royalties due under the license or were otherwise not in compliance with the terms of the license, the licensor might attempt to revoke the license. If such an attempt were successful and the license is terminated, we might be barred from marketing, producing, and selling some or all of our products, which would have an adverse effect on our business. Potential disputes between us and one of our existing licensors concerning the terms or conditions of the applicable license agreement could result, among other risks, in substantial management distraction; increased expenses associated with litigation or efforts to resolve disputes; substantial customer uncertainty concerning the direction of our product lines; potential infringement claims against us and/or our customers, which could include efforts by a licensor to enjoin sales of our products; customer requests for indemnification by us; and, in the event of an adverse determination, our inability to operate our business as currently operated. Termination of material license agreements could prevent us from manufacturing and selling our products unless we can negotiate new license terms or develop or acquire alternative intellectual property rights that cover or enable similar functionality. Any of these factors would be expected to have a material adverse effect on our business, operating results, and financial condition and could result in a substantial decline in our stock price.

We are subject to certain manufacturing restrictions related to licensed technologies that were developed with the financial assistance of U.S. governmental grants.

We are subject to certain U.S. government regulations because we have licensed technologies that were developed with U.S. government grants. In accordance with these regulations, these licenses provide that products embodying the technologies are subject to domestic manufacturing requirements. If this domestic manufacturing requirement is not met, the government agency that funded the relevant grant is entitled to exercise specified rights, referred to as “march-in rights,” which if exercised would allow the government agency to require the licensors or us to grant a non-exclusive, partially exclusive, or exclusive license in any field of use to a third party designated by such agency. All of our microfluidic systems revenue is dependent upon the availability of our IFCs, which incorporate technology developed with U.S. government grants. Our genomics instruments, including microfluidic systems, and IFCs are manufactured at our facility in Singapore. The federal regulations allow the funding government agency to grant, at the request of the licensors of such technology, a waiver of the domestic manufacturing requirement. Waivers may be requested prior to any government notification. We have assisted the licensors of these technologies with the analysis of the domestic manufacturing requirement, and, in December 2008, the sole licensor subject to the requirement applied for a waiver of the domestic manufacturing requirement with respect to the relevant patents licensed to us by this licensor. In July 2009, the funding government agency granted the requested waiver of the domestic manufacturing requirement for a three-year period commencing in July 2009. In June 2012, the licensor requested a continued waiver of the domestic manufacturing requirement with respect to the relevant patents, but the government agency has not yet taken any action in response to this request. If the government agency does not grant the requested waiver or the government fails to grant additional waivers of such requirement that may be sought in the future, then the U.S. government could exercise its march-in rights with respect to the relevant patents licensed to us. In addition, the license agreement under which the relevant patents are licensed to us contains provisions that obligate us to comply with this domestic manufacturing requirement. We are not currently manufacturing instruments and IFCs in the United States that incorporate the relevant licensed technology. If our lack of compliance with this provision constituted a material breach of the license agreement, the license of the relevant patents could be terminated or we could be compelled to relocate our manufacturing of microfluidic systems and IFCs to the United States to avoid or cure a material breach of the license agreement. Any of the exercise of march-in rights, the termination of our license of the relevant patents or the relocation of our manufacturing of microfluidic systems and IFCs to the United States could materially adversely affect our business, operations and financial condition.

We are subject to certain obligations and restrictions relating to technologies developed in cooperation with Canadian government agencies.

Some of our Canadian research and development is funded in part through government grants and by government agencies. The intellectual property developed through these projects is subject to rights and restrictions in favor of government agencies and Canadians generally. In most cases the government agency retains the right to use intellectual property developed through the project for non-commercial purposes and to publish the results of research conducted in connection with the project. This may increase the risk of public disclosure of information relating to our intellectual property, including confidential information, and may reduce its competitive advantage in commercializing intellectual property developed through these projects. In certain projects, we have also agreed to use commercially reasonable efforts to commercialize intellectual property in Canada, or more specifically in the province of Ontario, for the economic benefit of Canada and the province of Ontario. These restrictions will limit our choice of business and manufacturing locations, business partners and corporate structure and may, in certain circumstances, restrict our ability to achieve maximum profitability and cost efficiency from the intellectual property generated by these projects. In one instance, a dispute with the applicable government funded entity may require mediation, which could lead to unanticipated delays in our commercialization efforts to that project. One of our Canadian government funded projects is also subject to certain limited “march-in” rights in favor of the government of the Province of Ontario, under which we may be required to grant a license to our intellectual property, including background intellectual property developed outside the scope of the project, to a responsible applicant on reasonable terms in circumstances where the government determines that such a license is necessary in order to alleviate emergency or extraordinary health or safety needs or for public use. In addition, we must provide reasonable assistance to the government in obtaining similar licenses from third parties required in connection with the use of its intellectual property. Instances in which the government of the Province of Ontario has exercised similar “march-in” rights are rare; however, the exercise of such rights could materially adversely affect our business, operations and financial condition.

Risks Related to Our Common Stock

Our stock price may fluctuate significantly, particularly if holders of substantial amounts of our stock attempt to sell, and holders may have difficulty selling their shares based on current trading volumes of our stock. In addition, numerous other factors could result in substantial volatility in the trading price of our stock.

Our stock is currently traded on Nasdaq, but we can provide no assurance that we will be able to maintain an active trading market on Nasdaq or any other exchange in the future. The trading volume of our stock tends to be low relative to our total outstanding shares, and we have several stockholders who hold substantial blocks of our stock. As of December 31, 2019, we had 69,956,397 shares of common stock outstanding, and stockholders holding at least 5% of our stock, individually or with affiliated persons or entities, collectively beneficially owned or controlled approximately 46.3% of such shares and one stockholder beneficially owned approximately 9.8% of our outstanding common stock. Sales of large numbers of shares by any of our large stockholders could adversely affect our trading price, particularly given our relatively small historic trading volumes. If stockholders holding shares of our common stock sell, indicate an intention to sell, or if it is perceived that they will sell, substantial amounts of their common stock in the public market, the trading price of our common stock could decline. Moreover, if there is no active trading market or if the volume of trading is limited, holders of our common stock may have difficulty selling their shares. In addition, the concentration of ownership of our outstanding common stock (approximately 46.3% held by our top six stockholders) means that a relatively small number of stockholders have significant control over the outcomes of stockholder voting.

In addition, the trading price of our common stock may be highly volatile and could be subject to wide fluctuations in response to various factors, some of which are beyond our control. These factors include:

- actual or anticipated quarterly variation in our results of operations or the results of our competitors;
- announcements or communications by us or our competitors relating to, among other things, new commercial products, technological advances, significant contracts, commercial relationships, capital commitments, acquisitions or sales of businesses, and/or misperceptions in or speculation by the market regarding such announcements or communications;
- issuance of new or changed securities analysts’ reports or recommendations for our stock;
- developments or disputes concerning our intellectual property or other proprietary rights;
- commencement of, or our involvement in, litigation;
- market conditions in the life science, plant and animal research, and CRO sectors;
- failure to complete significant sales;
- manufacturing disruptions that could occur if we are unable to successfully expand our production in our current or an alternative facility;
- any future sales of our common stock or other securities in connection with raising additional capital or otherwise;
- any major change to the composition of our board of directors or management; and
- general economic conditions and slow or negative growth of our markets.

The stock market in general, and market prices for the securities of technology-based companies like ours in particular, have from time to time experienced volatility that often has been unrelated to the operating performance of the underlying companies. These broad market and industry fluctuations may adversely affect the market price of our common stock regardless of our operating performance. In several recent situations where the market price of a stock has been volatile, holders of that stock have instituted securities class action litigation against the company that issued the stock. If any of our stockholders were to bring a lawsuit against us, the defense and disposition of the lawsuit could be costly and divert the time and attention of our management and harm our operating results.

If securities or industry analysts publish unfavorable research about our business or cease to cover our business, our stock price and/or trading volume could decline.

The trading market for our common stock may rely, in part, on the research and reports that equity research analysts publish about us and our business. We do not have any control of the analysts or the content and opinions included in their reports. The price of our stock could decline if one or more equity research analysts downgrade our stock or issue other unfavorable commentary or research. If one or more equity research analysts ceases coverage of our company or fails to publish reports on us regularly, demand for our stock could decrease, which in turn could cause our stock price or trading volume to decline.

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

Provisions in our certificate of incorporation and bylaws may have the effect of delaying or preventing a change of control or changes in our management, including provisions that:

- authorize our board of directors to issue, without further action by the stockholders, up to 10,000,000 shares of undesignated preferred stock;
- require that any action to be taken by our stockholders be effected at a duly called annual or special meeting and not by written consent;
- specify that special meetings of our stockholders can be called only by our board of directors, the chairman of the board, the chief executive officer or the president;
- establish an advance notice procedure for stockholder approvals to be brought before an annual meeting of our stockholders, including proposed nominations of persons for election to our board of directors;
- establish that our board of directors is divided into three classes, Class I, Class II, and Class III, with each class serving staggered three-year terms;
- provide that our directors may be removed only for cause;
- provide that vacancies on our board of directors may be filled only by a majority of directors then in office, even though less than a quorum;
- specify that no stockholder is permitted to cumulate votes at any election of directors; and
- require a super-majority of votes to amend certain of the above-mentioned provisions.

These provisions may frustrate or prevent any attempts by our stockholders to replace or remove our current management by making it more difficult for stockholders to replace members of our board of directors, which is responsible for appointing the members of our management. In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which limits the ability of stockholders owning in excess of 15% of our outstanding voting stock to merge or combine with us.

We have never paid cash dividends on our capital stock, and we do not anticipate paying any cash dividends in the foreseeable future.

We have paid no cash dividends on any of our classes of capital stock to date and currently intend to retain our future earnings to fund the development and growth of our business. In addition, we cannot pay any cash dividends on any of our classes of common stock without approval from the lender under our Revolving Credit Facility, and may become subject to covenants under future debt arrangements that place restrictions on our ability to pay dividends. As a result, capital appreciation, if any, of our common stock will be stockholders' sole source of gain for the foreseeable future.

Any conversions of the 2014 Notes or 2019 Notes will dilute the ownership interest of our existing stockholders and may otherwise depress the price of our common stock.

Any conversion of some or all of the 2014 Notes or 2019 Notes will dilute the ownership interests of our existing stockholders. Any sales in the public market of our common stock issuable upon such conversion could also adversely affect prevailing market prices of our common stock. In addition, holders of the 2014 Notes or 2019 Notes may hedge their position in such Convertible Notes by entering into short positions with respect to the underlying common stock. As a result, any anticipated conversion of the 2014 Notes or 2019 Notes could depress the market price of our common stock and impair our ability to raise capital through the sale of additional equity securities.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

We lease approximately 69,000 square feet of office and laboratory space at our headquarters in South San Francisco, California under a lease that expires in March 2020. It will be replaced by a new operating lease for approximately 78,000 square feet in the same area. The term of the new lease, which is expected to commence when the old lease expires, is approximately 10 years. Additionally, we lease office, laboratory and manufacturing space in Singapore of approximately 40,000 square feet that expires in June 2022, and in Ontario, Canada approximately 44,500 square feet under a lease that expires in March 2026 and a second lease that was entered into during 2019 for approximately 19,000 square feet, which expires in March 2027. As of December 31, 2019, we also leased office space in Japan, China, and France, with various expiration dates through February 2026. In addition, we believe that our properties are in good condition and are adequate and suitable for their purposes. Refer to Note 7 of our consolidated financial statements for additional information about leased properties in this Form 10-K.

ITEM 3. LEGAL PROCEEDINGS

In the normal course of business, we are from time to time involved in legal proceedings or potential legal proceedings, including matters involving employment, intellectual property, or others. Although the results of litigation and claims cannot be predicted with certainty, we currently believe that the final outcome of any currently pending matters would not have a material adverse effect on our business, operating results, financial condition, or cash flows. Regardless of the outcome, litigation can have an adverse impact on us because of defense and settlement costs, diversion of management resources, and other factors.

ITEM 4. MINE SAFETY DISCLOSURES

Not applicable.

PART II

ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Market for Our Common Stock; Dividends

Our common stock began trading on the Nasdaq Global Select Market under the symbol "FLDM" on February 10, 2011.

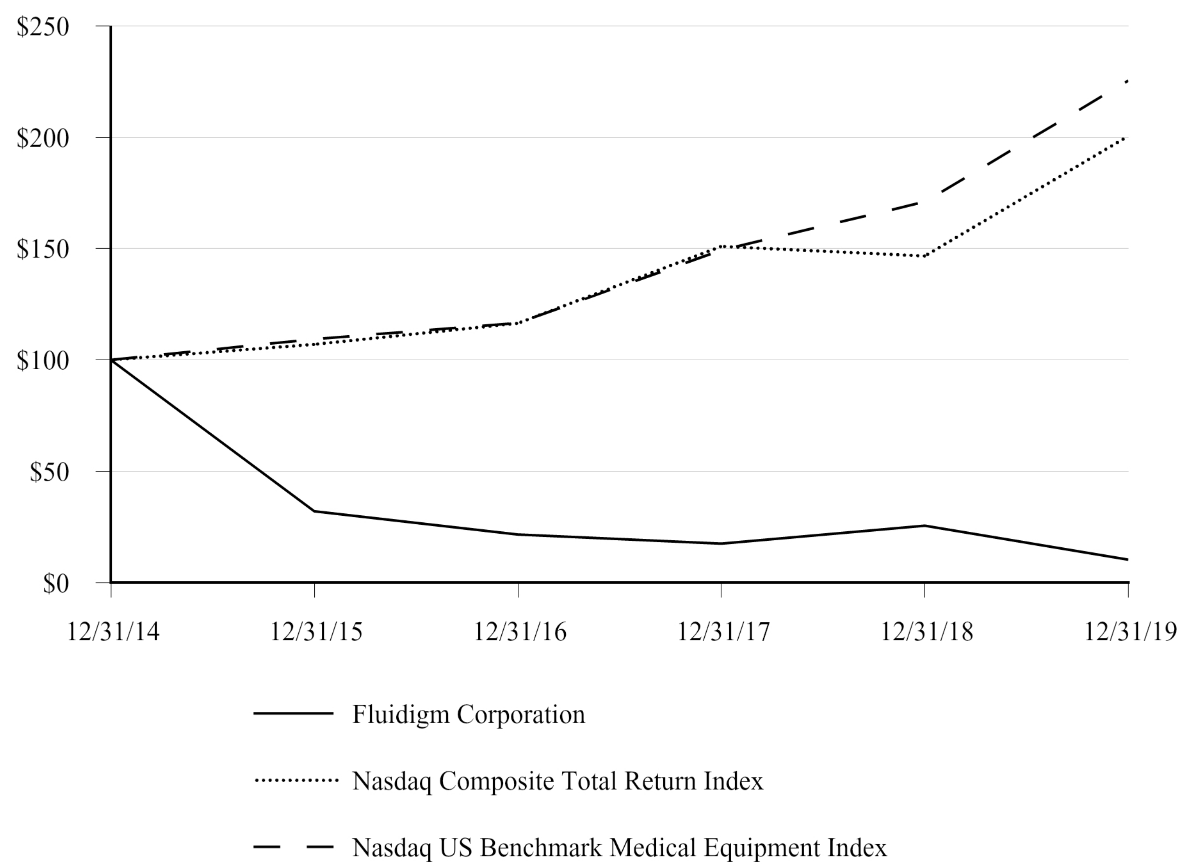
We had 87 stockholders of record as of January 31, 2020; however, because many of our outstanding shares are held by brokers or other institutions on behalf of stockholders, we are unable to estimate the total number of beneficial owners represented by the holders of record.

We have never declared or paid cash dividends on our common stock and do not expect to pay dividends on our common stock for the foreseeable future. Instead, we anticipate that all of our earnings in the foreseeable future will be used for the operation and growth of our business.

Stock Performance Graph

The following performance graph shall not be deemed "soliciting material" or to be "filed" with the SEC for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, or the Exchange Act, or otherwise subject to the liabilities under that Section, and shall not be deemed to be incorporated by reference into any filing of Fluidigm Corporation under the Securities Act or the Exchange Act.

The following graph compares, from December 31, 2014 through December 31, 2019, the cumulative total return for our common stock, the Nasdaq Composite Total Return Index, and the Nasdaq US Benchmark Medical Equipment Index, assuming in each case an initial investment of $100 and reinvestment of all dividends. Such returns are based on historical results and are not intended to suggest future performance.



Sales of Unregistered Securities

None.

Issuer Purchases of Equity Securities

We did not repurchase any shares of our common stock during the year ended December 31, 2019.

ITEM 6. SELECTED FINANCIAL DATA

The following selected financial data should be read in conjunction with the consolidated financial statements and related notes thereto appearing elsewhere in this Form 10-K. We have derived the consolidated statement of operations data for the years ended December 31, 2019, 2018, and 2017, and consolidated balance sheet data as of December 31, 2019, and December 31, 2018 from audited consolidated financial statements included elsewhere in this Form 10-K. The consolidated statement of operations data for the years ended December 31, 2016, and 2015, and the consolidated balance sheet data as of December 31, 2017, December 31, 2016, and December 31, 2015 were derived from audited consolidated financial statements that are not included in this Form 10-K.

	2019	2018	2017	2016	2015
	(in thousands, except per share amounts)				
Consolidated Statement of Operations Data:					
Total revenue	$ 117,243	$ 112,964	$ 101,937	$ 104,446	$ 114,712
Loss from operations	(51,839)	(48,164)	(58,360)	(73,190)	(50,155)
Net loss	(64,790)	(59,013)	(60,535)	(75,985)	(53,315)
Net loss per share, basic and diluted	(0.97)	(1.49)	(1.84)	(2.62)	(1.86)

	2019	2018	2017	2016	2015
	(in thousands)				
Consolidated Balance Sheet Data:					
Cash, cash equivalents, and short and long-term investments	$ 58,639	$ 95,401	$ 63,136	$ 59,430	$ 101,465
Working capital (1)	74,003	100,988	71,565	76,334	123,433
Total assets (2)	264,812	303,647	287,351	306,395	370,050
Total long-term debt (2)	53,821	172,058	195,238	194,951	194,673
Total stockholders' equity	153,612	72,116	30,935	53,233	114,901

(1) Working capital excludes deferred revenue.
(2) $1.0 million and $1.1 million of debt issuance costs for Convertible notes were previously included in Total assets reclassified to Total long-term debt as a deduction in December 31, 2015.

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

The following discussion and analysis should be read together with our consolidated financial statements and the notes to those statements included elsewhere in this Form 10-K. This discussion contains forward-looking statements based on our current expectations, assumptions, estimates and projections about Fluidigm and our industry. These forward-looking statements involve risks and uncertainties. Our actual results could differ materially from those indicated in these forward-looking statements as a result of certain factors, as more fully described in "Risk factors" in Item 1A of this Form 10-K, in this Item 7, and elsewhere in this Form 10-K. Except as may be required by law, we undertake no obligation to update publicly any forward-looking statements for any reason, even if new information becomes available or other events occur in the future.

Overview

Fluidigm is a global company that improves life through comprehensive health insight. Our innovative technologies and multi-omic tools are used by researchers to reveal meaningful insights into health and disease, identify biomarkers to inform decisions, and accelerate the development of more effective therapies. We create, manufacture, and market a range of products and services, including instruments, reagents and software that are used by researchers worldwide.

Our focus is on the most pressing needs in translational and clinical research, including cancer, immunology and immunotherapy. We use proprietary CyTOF® and microfluidics technologies to develop innovative end-to-end solutions that have the flexibility required to meet the needs of translational research and the robustness to support high-impact clinical research studies.

We sell our products to leading academic, government, pharmaceutical, biotechnology and plant and animal research laboratories worldwide. We distribute our systems through our direct sales force and support organizations located in North America, Europe, and Asia-Pacific, and through distributors or sales agents in several European, Latin American, Middle Eastern, and Asia-Pacific countries.

Our manufacturing operations are located in Singapore and Canada. Our facility in Singapore manufactures our genomics instruments, which are assembled by our contract manufacturer located within our Singapore facility. All of our IFCs for commercial sale and some IFCs for our research and development purposes are also fabricated at our Singapore facility. Our mass cytometry instruments for commercial sale, as well as for internal research and development purposes, are manufactured at our facility in Canada. We also manufacture assays and reagents at our facilities in Canada.

Our total revenue was $117.2 million in 2019, $113.0 million in 2018, and $101.9 million in 2017. We have incurred significant net losses since our inception in 1999 and, as of December 31, 2019, our accumulated deficit was $623.6 million.

Recent Developments

In November 2019, we closed a private placement to qualified institutional buyers pursuant to Rule 144A under the Securities Act of $55.0 million aggregate principal amount of our 2019 Notes. Net proceeds of the 2019 Notes issuance were $52.7 million, after deductions for commissions and other debt issuance costs. $51.8 million of the proceeds was used to retire $50.2 million aggregate principal amount of our 2014 Notes. Pursuant to the indenture governing the 2014 Notes, holders of the 2014 Notes have the right, subject to certain conditions specified in such indenture, to require the Company to purchase their 2014 Notes beginning in February 2021. The private placement of the 2019 Notes and concurrent repurchase of a portion of the 2014 Notes had the effect of refinancing a portion of the Company's outstanding debt under the 2014 Notes to December 2024.

The 2019 Notes bear interest at 5.25% per annum, payable semiannually on June 1 and December 1 of each year, beginning on June 1, 2020. The 2019 Notes will mature on December 1, 2024, unless earlier repurchased or converted pursuant to their terms. The 2019 Notes will be convertible at the option of the holder at any point prior to the close of business on the second scheduled trading day preceding the maturity date. The initial conversion rate of the 2019 Notes is 344.8276 shares of the Company's common stock per $1,000 principal amount of 2019 Notes (which is equivalent to an initial conversion price of approximately $2.90 per share). The conversion rate will be subject to adjustment upon the occurrence of certain specified events but will not be adjusted for any accrued and unpaid interest.

The 2019 Notes will also be convertible at our option upon certain conditions in accordance with the terms of the indenture governing the 2019 Notes. On or after December 1, 2021 to December 1, 2022, if the price of the Company's common stock has equaled or exceeded 150% of the Conversion Price (as defined in the indenture, currently $2.90, subject to adjustment) for a specified number of days (Issuer's Conversion Option), we may, at our option, elect to convert the 2019 Notes in whole but not in part into shares of the Company's common stock, determined in accordance with the terms of the indenture. On or after December 1, 2022, if the price of the Company's common stock has equaled or exceeded 130% of the

Conversion Price then in effect for a specified number of days, we may, at our option, elect to convert the 2019 Notes in whole but not in part into shares of the Company's common stock, determined in accordance with the terms of the indenture. This transaction is described in more detail in Note 6 of our consolidated financial statements.

In March 2019, we experienced a ransomware attack that infiltrated and encrypted certain of our information technology systems, including systems containing critical business data. Immediately following the attack, actions were taken to recover the compromised systems and we believe we were able to restore their operation without significant loss of business data. Based on the nature of the attack and its impact on our systems, we do not believe confidential data was lost or disclosed. We were able to recover the majority of the costs associated with the intrusion under an applicable insurance policy. Although we believe we have contained the disruption from the March 2019 attack, we anticipate additional work and expense in the future as we continue to enhance our security processes and initiatives in response to ever-evolving information security threats.

Critical Accounting Policies, Significant Judgments and Estimates

Our consolidated financial statements and the related notes included elsewhere in this Form 10-K are prepared in accordance with accounting principles generally accepted in the United States. The preparation of these consolidated financial statements requires us to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenue, costs, and expenses and related disclosures. We base our estimates on historical experience and on various other assumptions that we believe to be reasonable under the circumstances. Changes in accounting estimates may occur from period to period. Accordingly, actual results could differ significantly from the estimates made by our management. We evaluate our estimates and assumptions on an ongoing basis. To the extent that there are material differences between these estimates and actual results, our future financial statement presentation, financial condition, results of operations, and cash flows will be affected.

We believe that the following critical accounting policies involve a greater degree of judgment and complexity than our other accounting policies. Accordingly, these are the policies we believe are the most critical to understanding and evaluating of our audited 2019 consolidated financial statements.

Revenue Recognition

We adopted ASC 606 Revenue from Contracts with Customers on January 1, 2018 and all the related amendments using the modified retrospective method. The Company recognized the cumulative effect of initially applying the new revenue standard as an adjustment to the opening balance of accumulated deficit as of January 1, 2018. The comparative information for 2017 has not been recast and continues to be reported under the accounting standards in effect for that period.

We generate revenue primarily from sales of our products and services. Our product revenue consists of sales of our mass cytometry, high-throughput genomics and single-cell genomics instruments and consumables, including IFCs, assays, and other reagents. Our service revenue consists of post-warranty service contracts, preventive maintenance plans, repairs, installation, training and other specialized product support services. We also receive grants from various entities to perform research and development activities over contractually defined periods. Revenue is reported net of any sales, use and value-added taxes, which we collect from customers as required by government authorities.

We recognize revenue based on the amount of consideration we expect to receive in exchange for the goods and services we transfer to the customer. Our commercial arrangements typically include multiple distinct products and services, and we allocate revenue to these performance obligations based on their relative standalone selling prices. Standalone selling prices (SSPs) are generally determined using observable data from recent transactions. In cases where sufficient data is not available, we estimate a product's SSP using a cost plus a margin approach or by applying a discount to the product's list price.

Product Revenue

We recognize product revenue at the point in time when control of the goods passes to the customer and we have an enforceable right to payment. This generally occurs either when the product is shipped from one of our facilities or when it arrives at the customer's facility, based on the contractual terms. Customers generally do not have a unilateral right to return products after delivery. Invoices are generally issued at shipment and become due in 30 to 60 days.

Service Revenue

We recognize revenue from repairs, maintenance, installation, training and other specialized product support services at the point in time the work is completed. Installation and training services are generally billed in advance of service. Repairs and other services are generally billed at the point the work is completed.

Revenue associated with instrument service contracts is recognized on a straight-line basis over the life of the agreement, which is generally one to three years. We believe this approach is appropriate for service contracts because we provide services on demand throughout the term of the agreement. Invoices are generally issued in advance of service on a monthly, quarterly, annual or multi-year basis. Payments made in advance of service are reported on our consolidated balance sheet as deferred revenue.

Contract Costs

Incremental sales commission costs incurred to obtain instrument service contracts are capitalized and amortized to selling, general and administrative expense over the life of the contract, which is generally one to three years. As a practical expedient, we expense sales commissions associated with product support services that are delivered in less than one year as they are incurred. Sales commissions associated with the sale of products are expensed as they are incurred. To date, capitalized contract costs have been immaterial.

Product Warranties

We generally provide a one-year warranty on our instruments. We accrue for estimated warranty obligations at the time of product shipment. We periodically review our warranty liability and record adjustments based on the terms of warranties provided to customers, and historical and anticipated warranty claim experience. This expense is recorded as a component of cost of product revenue in the consolidated statements of operations.

Significant Judgments

Applying the revenue recognition practices discussed above often requires significant judgment. Judgment is required when identifying performance obligations, estimating SSP and allocating purchase consideration in multi-element arrangements and estimating the future amount of our warranty obligations. Significant judgment is also required when interpreting commercial terms and determining when control of goods and services passes to the customer. Any material changes created by errors in judgment could have a material effect on our operating results and overall financial condition.

Goodwill, Intangible Assets and Other Long-Lived Assets

Goodwill, which has an indefinite useful life, represents the excess of cost over fair value of net assets acquired. Our intangible assets include developed technology, patents and licenses. The cost of identifiable intangible assets with finite lives is generally amortized on a straight-line basis over the assets' respective estimated useful lives.

Goodwill and intangible assets with indefinite lives are not subject to amortization but are tested for impairment on an annual basis during the fourth quarter or whenever events or changes in circumstances indicate the carrying amount of these assets may not be recoverable. Events or changes in circumstances that could affect the likelihood that we will be required to recognize an impairment charge include, but are not limited to, declines in our stock price or market capitalization, declines in our market share or revenues, and an increase in our losses, rapid changes in technology, failure to achieve the benefits of capacity increases and utilization, significant litigation arising out of an acquisition, or other matters. Any impairment charges could have a material adverse effect on our operating results and net asset value in the quarter in which we recognize the impairment charge.

In evaluating our goodwill and intangible assets with indefinite lives for indications of impairment, we first conduct an assessment of qualitative factors to determine whether it is more likely than not that the fair value of our reporting unit is less than its carrying amount. If we determine that it is more likely than not that the fair value of our reporting unit is less than its carrying amount, we then conduct a two-step test for impairment of goodwill. In the first step, we compare the fair value of our reporting unit to its carrying value. If the fair value of our reporting unit exceeds its carrying value, goodwill is not considered impaired and no further analysis is required. If the carrying value of the reporting unit exceeds its fair value, then the second step of the impairment test must be performed in order to determine the implied fair value of the goodwill. If the carrying value of the goodwill exceeds its implied fair value, then an impairment loss equal to the difference would be recorded. We did not recognize any impairment of goodwill for any of the periods presented herein.

We evaluate our long-lived assets, including finite-lived intangibles, for indicators of possible impairment when events or changes in circumstances indicate the carrying amount of an asset may not be recoverable. If any indicators of impairment exist, we assess the recoverability of the affected long-lived assets by determining whether the carrying value of the asset can be recovered through undiscounted future operating cash flows. If impairment is indicated, we estimate the asset's fair value using future discounted cash flows associated with the use of the asset and adjust the carrying value of the asset accordingly. In the fourth quarter of 2019, we recognized an impairment charge of $0.4 million on patents and licenses that are not used in any current products and are not expected to be used in future product offerings.

Convertible Notes

In February 2014, we closed an underwritten public offering of $201.3 million aggregate principal amount of our 2014 Notes. In March 2018, we entered into separate privately negotiated transactions with certain holders of our 2014 Notes to exchange $150.0 million in aggregate principal amount of the 2014 Notes for 2.75% Exchange Convertible Senior Notes due 2034 (2018 Notes). Following the exchange, approximately $51.3 million in aggregate principal amount of the 2014 Notes remained outstanding, together with $150.0 million in aggregate principal amount of the 2018 Notes.

As the 2018 Notes were convertible, at our election, into cash, shares of our common stock, or a combination of cash and shares of our common stock, we accounted for the 2018 Notes under the cash conversion guidance in ASC 470, whereby the embedded conversion option in the 2018 Notes was separated and accounted for in equity. The embedded conversion option value was calculated as the difference between (i) the total fair value of the 2018 Notes and (ii) the fair value of a similar debt instrument excluding the embedded conversion option. We determined an embedded conversion option value of $29.3 million, which was recorded in additional paid-in-capital and reduced the carrying value of the 2018 Notes. The resulting discount on the 2018 Notes was amortized over the expected term of the 2018 Notes, using the effective interest method through the first note holder put date, of February 6, 2023. In the first quarter of 2019, the 2018 Notes were converted into approximately 19.5 million shares of common stock and the 2018 Notes were retired. We recorded a loss of $9.0 million on the retirement of the 2018 Notes. This amount represents the difference between the fair value of the bonds converted and the carrying value of the bonds at the time of conversion, including unamortized premiums, discounts and debt issuance costs. We have determined the fair value of the 2018 Notes using valuation techniques that require us to make assumptions related to the implied discount rate.

In November 2019, we closed a private placement to qualified institutional buyers pursuant to Rule 144A under the Securities Act of $55.0 million aggregate principal amount of our 2019 Notes. The majority of the issuance proceeds were used to retire approximately $50.2 million of aggregate principal amount of our 2014 Notes, leaving approximately $1.1 million of aggregate principal amount of our 2014 Notes outstanding. We recorded a loss of $3.0 million on the extinguishment of the 2014 Notes. This amount represents the difference between the fair value of the 2019 Notes used to extinguish the debt and the carrying value of the 2014 Notes, including unamortized debt issuance costs.

As the 2019 Notes do not provide for a cash conversion feature, the 2019 Notes are recorded as debt in their entirety in accordance with ASC 470. For the 2014, 2018 and 2019 Notes, offering-related costs, including underwriting costs, were capitalized as debt issuance costs, recorded as an offset to the carrying value of the related Notes, and are amortized over the expected term of the related Notes using the effective interest method.

Stock-Based Compensation

Our board of directors sets the terms, conditions, and restrictions related to our Employee Stock Purchase Plan (ESPP) and the grant of stock options, Restricted Share Units (RSUs) and performance-based awards (PSUs) under our various stock-based plans. Our board of directors determines the number of awards to grant and sets the vesting criteria. For PSUs, our board of directors sets the performance objectives and other vesting provisions in determining the number of shares or value of performance units and performance shares that will be paid out. Such payout will be a function of the extent to which performance objectives or other vesting provisions have been achieved.

We recognize compensation costs for all stock-based awards, including stock options, RSUs, and stock purchased under our ESPP, based on the grant date fair value of the award. We recognize stock-based compensation expense on a straight-line basis over the requisite service periods for non-performance-based awards. For RSUs, fair value is measured based on the closing fair market value of our common stock on the date of grant. For PSUs with a market condition, we used a Monte Carlo simulation pricing model to incorporate the market condition effects at our grant date. For PSUs with performance conditions, stock-based compensation expense is recognized over the requisite service period when the achievement of each individual performance goal becomes probable.

The fair value of options and stock purchases under ESPP on the grant date is estimated using the Black-Scholes option-pricing model, which requires the use of certain subjective assumptions, including expected term, volatility, risk-free interest rate and the fair value of our common stock. These assumptions generally require significant judgment. We determine the expected volatility based on our historical stock price volatility generally commensurate with the estimated expected term of the stock awards. The expected term of an award is based on historical forfeiture experience, exercise activity, and the terms and conditions of the stock awards. The risk-free interest rate is based on the U.S. Treasury yield in effect at the time of grant for zero coupon U.S. Treasury notes with maturities approximately equal to each grant's expected term. We account for forfeitures as they occur.

Income Taxes

We use the asset and liability method to account for income taxes. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. Significant management judgment is required in determining our provision for income taxes, our deferred tax assets and liabilities, and any valuation allowance recorded against our deferred tax assets. Our provision for income taxes primarily consists of foreign tax expense/benefit.

As part of the process of preparing our consolidated financial statements, we continuously monitor the circumstances impacting the expected realization of our deferred tax assets for each jurisdiction. We consider all available evidence, including historical operating results in each jurisdiction, expectations and risks associated with estimates of future taxable income, and ongoing prudent and feasible tax planning strategies in assessing the need for a valuation allowance. To the extent a deferred tax asset cannot be recognized, a valuation allowance is established to reduce our deferred tax assets to the amount that is more likely than not to be realized. These deferred tax assets primarily consist of net operating loss carryforwards and research and development tax credits. We intend to maintain such valuation allowance until sufficient evidence exists to support its reduction. Our deferred tax liabilities primarily consist of book and tax basis differences in fixed assets and acquired identifiable intangible assets. We make estimates and judgments about our future taxable income that are based on assumptions that are consistent with our plans and estimates. Should the actual amounts differ from our estimates, the amount of our valuation allowance could be materially impacted. Changes in these estimates may result in significant increases or decreases to our tax provision in a period in which such estimates are changed, which in turn would affect net income or loss.

We recognize the financial statement effects of a tax position when it is more likely than not, based on the technical merits, that the position will be sustained upon examination. Any interest and penalties related to uncertain tax positions are reflected in the income tax provision.

At December 31, 2017, we changed our permanent reinvestment assertion and will not permanently reinvest our foreign earnings outside the United States. The cash generated from some of our foreign subsidiaries may be used domestically to fund operations. Any domestic, foreign withholding tax and state taxes that may be due upon future repatriation of earnings is not expected to be significant.

Inventory Valuation

Inventories are stated at the lower of cost (on a first-in, first-out basis) or net realizable value. Inventory costs include direct materials, direct labor, and normal manufacturing overhead. Finished goods that are used for research and development are expensed as consumed or depreciated over their period of use. We regularly review inventory for excess and obsolete products and components. Provisions for slow-moving, excess, and obsolete inventories are recorded when required to reduce inventory values to their estimated net realizable values based on product life cycle, development plans, product expiration, and quality issues.

Recent Accounting Changes and Accounting Pronouncements

Adoption of New Accounting Guidance

In February 2016, the FASB established Topic 842, Leases, by issuing Accounting Standards Update (ASU) No. 2016-02, which requires lessees to recognize operating leases on the balance sheet and disclose key information about leasing arrangements. Topic 842 was subsequently amended by ASU No. 2018-01, Land Easement Practical Expedient for Transition to Topic 842; ASU No. 2018-10, Codification Improvements to Topic 842, Leases; and ASU No. 2018-11, Targeted Improvements. The new standard establishes a right-of-use (ROU) model that requires a lessee to recognize a ROU asset and lease liability on the balance sheet for all leases with a term longer than 12 months. Leases are classified as finance or operating; the classification will impact the expense recognition in the income statement.

A Modified Retrospective Transition approach is required, applying the new standard to all leases existing at the date of initial application. An entity may choose to use either (i) its effective date or (ii) the beginning of the earliest comparative period presented in the financial statements as its date of initial application. We adopted the new standard on January 1, 2019 and used the effective date of the standard as our date of initial application. Consequently, previously presented financial information has not been updated, and the disclosures required under the new standard have not been provided for dates and periods before January 1, 2019. For dates and periods prior to January 1, 2019, the original disclosures under ASC 840 are disclosed.

The new standard provides several optional practical expedients in transition. We elected the 'package of practical expedients,' which permits us to not reassess under the new standard our prior conclusions about lease identification, lease classification and initial direct costs. We did not elect the use-of-hindsight or the practical expedient pertaining to land easements; the latter not being applicable to us.

On adoption of the new standard, we recognized $9.2 million of lease liabilities, based on the present value of the current minimum lease payments, discounted using our collateralized incremental borrowing rate, with corresponding ROU assets of $7.4 million. The difference between the initial lease liability and ROU asset is attributable to deferred rent. There was no impact to accumulated deficit from the adoption of ASC 842.

The new standard also provides certain accounting elections for an entity's ongoing accounting. We elected the short-term lease recognition exemption for all leases that qualify. This means that, for those leases that qualify, we will not recognize ROU assets or lease liabilities for leases with an initial lease term of one year or less. We also elected to not separate lease and nonlease components for our building leases. The nonlease components are generally variable in nature and are expected to represent most of our variable lease costs. Variable costs are expensed as incurred. We have taken a portfolio approach for our vehicle leases by country. We determine whether an arrangement is a lease, or contains a lease, at inception.

Recent Accounting Pronouncements

In November 2019, the FASB issued ASU 2019-12 Income Taxes (Topic 740)-Simplifying the Accounting for Income Taxes. The amendments in this update improve consistent application of and simplifies GAAP for Topic 740 by clarifying and amending existing guidance including intra-period allocation, reporting tax law changes and losses in interim periods, state and local taxes not fully based on income and recognition of deferred tax liability related to certain transactions. There is also new guidance related to consolidated group reporting and tax impacts resulting from business combinations. The new guidance is effective for fiscal years beginning after December 15, 2020. We are currently evaluating the impact of adoption on our consolidated financial statements.

In August 2018, the FASB issued ASU 2018-15 Intangibles-Goodwill and Other-Internal-Use Software (Subtopic 350-40), which establishes new guidance on the accounting for costs incurred to implement a cloud computing arrangement that is considered a service arrangement. The new guidance requires the capitalization of such costs, aligning it with the accounting for costs associated with developing or obtaining internal-use software. The new guidance is effective for fiscal years beginning after December 15, 2019. The adoption of the new guidance is not expected to have a significant impact on our financial results.

In January 2017, the FASB issued ASU 2017-04, Intangibles-Goodwill and Other (Topic 350): Simplifying the Test for Goodwill Impairment. The ASU eliminates the requirement for an entity to calculate the implied fair value of goodwill to measure a goodwill impairment charge. Instead, an entity performs its annual, or interim, goodwill impairment testing by comparing the fair value of a reporting unit with its carrying amount and recording an impairment charge for the amount by which the carrying amount exceeds the fair value. The ASU will be effective for annual and interim goodwill impairment testing performed for our fiscal years beginning January 1, 2020, with early adoption permitted. The adoption of the new guidance is not expected to have a significant impact on our financial results.

The FASB issued two ASUs related to financial instruments - credit losses. The ASUs issued were: (i) in June 2016, ASU 2016-13, Financial Instruments-Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments, and (ii) in November 2018, ASU 2018-19-Codification Improvements to Topic 326, Financial Instruments-Credit Losses. ASU 2016-13 is intended to improve financial reporting by requiring more timely recording of credit losses on loans and other financial instruments held by financial institutions and other organizations. ASU 2018-19 clarifies that receivables arising from operating leases are not within the scope of the credit losses standard, but rather, should be accounted for in accordance with the leasing standard. These ASUs are effective for fiscal years beginning after December 15, 2019, and interim periods within those years, with early adoption permitted. The modified retrospective method is required upon adoption. The adoption of the new guidance is not expected to have a significant impact on our financial results.

Results of Operations

The following table presents our historical consolidated statements of operations data for the years ended December 31, 2019, 2018, and 2017, and as a percentage of total revenue for the respective years (in thousands):

	Year Ended December 31,					
	2019		2018		2017	
Revenue:						
Total revenue	$117,243	100 %	$112,964	100 %	$101,937	100 %
Cost of sales:						
Total cost of sales	52,964	45	51,315	45	49,955	49
Gross profit	64,279	55	61,649	55	51,982	51
Operating expenses:						
Research and development	31,640	27	30,030	27	30,826	30
Selling, general and administrative	84,478	72	79,783	71	79,516	78
Total operating expenses	116,118	99	109,813	98	110,342	108
Loss from operations	(51,839)	(44)	(48,164)	(43)	(58,360)	(57)
Interest expense	(4,279)	(4)	(13,893)	(12)	(5,824)	(6)
Loss from extinguishment of debt	(12,020)	(10)	—	—	—	—
Other income, net	1,433	1	637	1	385	1
Loss before income taxes	(66,705)	(57)	(61,420)	(54)	(63,799)	(62)
Income tax benefit	1,915	2	2,407	2	3,264	3
Net loss	$ (64,790)	(55)%	$ (59,013)	(52)%	$ (60,535)	(59)%

Revenue

We generate revenue primarily from sales of our products and services, and from grant agreements. Our product revenue consists of sales of instruments and consumables. Consumable revenues are largely driven by the size of our installed base of instruments and the annual level of pull-through per instrument. Service revenue is linked to our sales of instruments as our service revenue consists of post-warranty service contracts, preventive maintenance plans, instrument parts, installation and training. We also receive grants from various entities to perform research and development activities over contractually defined periods. Our license revenue is generated primarily in the United States and relates to licensing our technology to third-parties.

We sell our products to leading academic, government, pharmaceutical, biotechnology and plant and animal research laboratories worldwide.

No single customer represented more than 10% of our total revenue for 2019, 2018, or 2017. Revenue from our five largest customers was 17% of total revenue both for 2019 and 2018, and 14% for 2017, respectively.

The following table presents our revenue by source for the years ended December 31, 2019, 2018, and 2017, and as a percentage of total revenue for the respective years (in thousands):

	Year Ended December 31,						Change	
	2019		2018		2017		2019	2018
Revenue:								
Instruments	$ 50,004	43%	$ 45,491	40%	$ 42,505	42%	10 %	7 %
Consumables	45,412	39	48,159	43	41,894	41	(6)%	15 %
Product revenue	95,416	82%	93,650	83%	84,399	83%	2 %	11 %
Service revenue	21,277	18	19,314	17	17,348	17	10 %	11 %
Grant revenue	550	—	—	—	—	—	NA	— %
License revenue	—	—	—	—	190	—	NA	(100)%
Total revenue	$ 117,243	100%	$ 112,964	100%	$ 101,937	100%	4 %	11 %

The following table presents our total revenue by geographic area of our customers and as a percentage of total revenue for each year presented (in thousands):

	Year Ended December 31,						Change	
	2019		2018		2017		2019	2018
Americas	$ 47,016	40%	$ 51,172	46%	$ 49,290	48%	(8)%	4%
EMEA	40,024	34	36,617	32	32,642	32	9 %	12%
Asia-Pacific	30,203	26	25,175	22	20,005	20	20 %	26%
Total revenue	$117,243	100%	$112,964	100%	$101,937	100%	4 %	11%

The Americas revenue includes revenue generated in the United States of $43.4 million, $48.1 million, and $45.8 million for 2019, 2018 and 2017, respectively. Asia-Pacific revenue includes sales to customers in China of $15.4 million, $14.0 million and $11.1 million for 2019, 2018 and 2017, respectively. Except for China, no other foreign country or jurisdiction had sales in excess of 10% of our total revenue during the years 2019, 2018 and 2017.

The following section includes management discussion and analysis for the fiscal year ended December 31, 2019. Refer to Part I Item 7 of the Annual Report on Form 10-K for the fiscal year ended December 31, 2018, filed with the SEC on March 18, 2019, for a discussion of the comparative results for 2018 and 2017, which discussion of comparative results is incorporated by reference into this Form 10-K.

Total Revenue

Total revenue increased by $4.3 million or 4%, to $117.2 million for 2019 compared to $113.0 million for 2018, primarily attributable to increases in mass cytometry instruments, consumables and service revenue, partially offset by lower microfluidics revenue.

Americas revenues declined by 8%, due to lower instrument and consumables product revenues, partially offset by higher service and grant revenues. EMEA revenues grew 9%, driven primarily by higher instrument sales. Unfavorable foreign exchange rates had a negative 3% point impact on EMEA revenue growth. The 20% increase in Asia-Pacific revenues is due to increases in instrument sales and service revenue, partially offset by lower consumables revenue. On a company-wide basis, weaker foreign exchange rates negatively impacted revenues by less than 1% for 2019 compared to 2018.

Product Revenue

Product revenue increased by $1.8 million, or 2%, to $95.4 million for 2019 from $93.7 million in 2018 due to higher sales volumes of mass cytometry instruments and consumables, partially offset by lower average selling prices of mass cytometry instruments and lower revenues from microfluidics products.

We expect the average selling prices of our products to fluctuate over time based on market conditions, product mix, and currency fluctuations.

Service Revenue

Service revenue increased by $2.0 million, or 10%, to $21.3 million for 2019 compared to 2018, primarily due to higher revenues from service agreements and product maintenance fees on mass cytometry products. Revenue from post-warranty service contracts are generally recognized in the year following instrument purchases.

Cost of Revenue, Gross Profit and Gross Margin

Cost of product revenue includes manufacturing costs incurred in the production process, including component materials, labor and overhead, installation, packaging, and delivery costs. In addition, cost of product revenue includes amortization of developed technology and intangibles, royalty costs for licensed technologies included in our products, warranty, provisions for slow-moving and obsolete inventory, and stock-based compensation expense. Our cost of product revenue and related product margin may fluctuate depending on the capacity utilization of our manufacturing facilities in response to market conditions and the demand for our products.

Cost of service revenue includes direct labor hours, overhead, and instrument parts. Our cost of service revenue and related service margin may fluctuate depending on the variability in material and labor costs of servicing instruments.

The following table presents our costs of product and service revenue, gross profit and gross margin for each year presented (in thousands):

	Year Ended December 31,			2019 vs. 2018 change	2018 vs. 2017 change
	2019	2018	2017		
Cost of product revenue	$45,461	$44,861	$45,039	1%	— %
Cost of service revenue	7,503	6,454	4,916	16%	31 %
Total cost of revenue	$52,964	$51,315	$49,955	3%	3 %
Gross profit	$64,279	$61,649	$51,982	4%	19 %
Gross margin	54.8%	54.6%	51.0%	0.2 ppts	3.6 ppts

Gross margin increased by 0.2 percentage points during 2019 compared to 2018. Higher capacity utilization, as well as the impact of spreading fixed depreciation and amortization over a higher revenue base, contributed to the improvement in gross margin, partially offset by higher inventory reserves, unfavorable product mix and lower average selling price on mass cytometry products.

Gross margin increased by 3.6 percentage points during 2018 compared to 2017. The year-over-year increase in gross margin was due to favorable manufacturing capacity utilization and product mix, coupled with the impact of fixed amortization on a higher revenue base in 2018.

Operating Expenses

The following table presents our operating expenses for each year presented (in thousands):

	Year Ended December 31,			2019 vs. 2018 change	2018 vs. 2017 change
	2019	2018	2017		
Research and development	$ 31,640	$ 30,030	$ 30,826	5%	(3)%
Selling, general and administrative	84,478	79,783	79,516	6%	— %
Total operating expenses	$116,118	$109,813	$110,342	6%	— %

Research and Development

Research and development expense consists primarily of compensation-related costs, product development and material expenses, and other allocated facilities and information technology expenses. We have made substantial investments in research and development since our inception. Our research and development efforts have focused primarily on enhancing our technologies and supporting development and commercialization of new and existing products and services.

Research and development expense increased by $1.6 million, or 5%, to $31.6 million for 2019 compared to $30.0 million for 2018. Increases included $1.7 million of new product development costs and a $0.4 million of an impairment loss related to a patent. The impact of higher headcount was largely offset by lower incentive compensation accruals.

We believe that our continued investment in research and development is essential to our long-term competitive position and that these expenses may increase in future periods.

Selling, General and Administrative

Selling, general and administrative expense consists primarily of personnel costs for our sales and marketing, business development, finance, legal, human resources, and general management, as well as professional services, such as legal and accounting services.

Selling, general and administrative expense increased by $4.7 million, or 6%, to $84.5 million for 2019 compared to $79.8 million for 2018. Business development costs increased $1.7 million, along with a $1.4 million increase in advertising and promotional costs. We also incurred $1.3 million of severance and other costs associated with transferring certain operations from South San Francisco to Markham, Ontario. Compensation-related costs increased $0.5 million in total, reflecting an 8% increase in headcount, including several senior executives. These compensation-related cost increases were largely offset by lower accruals for incentive compensation and the absence of retention bonus expense which was recorded in 2018.

Interest Expense, Loss on Extinguishment of Debt and Other Income, Net

The following table presents these items for each year presented (in thousands):

	Year Ended December 31,			2019 vs. 2018 change	2018 vs. 2017 change
	2019	2018	2017		
Interest expense	$ (4,279)	$ (13,893)	$ (5,824)	69 %	(139)%
Loss on extinguishment of debt	(12,020)	—	—	NM	NM
Other income, net	1,433	637	385	(125)%	(65)%
Total	$ (14,866)	$ (13,256)	$ (5,439)	(12)%	(144)%

In February 2014, we closed an underwritten public offering of $201.3 million aggregate principal amount of our 2014 Notes. In March 2018, we entered into separate privately negotiated transactions with certain holders of our 2014 Notes to exchange $150.0 million in aggregate principal amount of the 2014 Notes for our 2018 Notes. Following the exchange, approximately $51.3 million in aggregate principal amount of the 2014 Notes remained outstanding, together with $150.0 million in aggregate principal amount of the 2018 Notes.

In the first quarter of 2019, the 2018 Notes were converted into approximately 19.5 million shares of common stock and the 2018 Notes were retired. The decrease in interest expense in 2019 as compared to 2018 is primarily due to the retirement of this debt. We recognized a loss of $9.0 million on the conversion of 2018 Notes, which is included in loss on extinguishment of debt. This amount represents the difference between the fair value of the bonds converted and the carrying value of the bonds at the time of conversion.

On November 22, 2019, we closed a private placement to qualified institutional buyers pursuant to Rule 144A under the Securities Act of $55.0 million aggregate principal amount of our 2019 Notes. $51.8 million of the net proceeds were used to retire $50.2 million in aggregate principal amount of our 2014 Notes. Pursuant to the Indenture governing the 2014 Notes, holders of the 2014 Notes have the right, subject to certain conditions specified in such indenture, to require the Company to purchase their 2014 Notes beginning in February 2021. The private placement of the 2019 Notes, and concurrent repurchase of a portion of the 2014 Notes, had the effect of refinancing a portion of the Company's debt under the 2014 Notes until 2024 (i.e., the maturity date of the 2019 Notes). We recognized a loss of $3.0 million on the extinguishment of the 2014 Notes, which is also included in loss on extinguishment of debt. This amount represents the difference between the fair value of the 2019 Notes used to extinguish the debt and the carrying value of the 2014 Notes.

Other income, net primarily consists of interest income and gains or losses on foreign exchange. Other income, net, of $1.4 million for 2019 is primarily attributable to $1.3 million of interest income, and $0.1 million of foreign exchange gains.

Income Tax Benefit

Our tax provision is generally driven by three components: (i) tax provision from our foreign operations, (ii) tax benefits from the amortization of acquisition-related intangible assets, and (iii) discrete items, such as changes in valuation allowances or adjustments upon finalization of tax returns. Depending on the relative value of these components, we can have either a tax benefit or expense for any given period.

We recorded a tax benefit of $1.9 million, or an effective tax rate benefit of 2.9%, for the year ended December 31, 2019. The tax benefit was principally due to the amortization of our acquisition-related deferred tax liability, partially offset by a provision from our foreign operations.

Liquidity and Capital Resources

Sources of Liquidity

As of December 31, 2019, our principal sources of liquidity consisted of $21.7 million of cash and cash equivalents, and $37.0 million of short-term investments, as well as $2.1 million of restricted cash and $8.9 million of availability under our Revolving Credit Facility.

The following table presents our cash flow summary for each year presented (in thousands):

	Year Ended December 31,		
	2019	2018	2017
Cash flow summary:			
Net cash used in operating activities	$ (35,210)	$ (25,201)	$ (24,098)
Net cash provided by (used in) investing activities	(39,301)	4,719	17,658
Net cash provided by financing activities	2,790	57,660	28,997
Net increase (decrease) in cash, cash equivalents and restricted cash	(71,665)	37,345	23,011

Net Cash Used in Operating Activities

We derive cash flows from operations primarily from cash collected from the sale of our products and services, and license agreements and grants. Our cash flows from operating activities are also significantly influenced by our use of cash for operating expenses and working capital to support the business. We have historically experienced negative cash flows from operating activities as we have expanded our business and built our infrastructure domestically and internationally.

Net cash used in operating activities in 2019 was $35.2 million and consisted of net loss of $64.8 million less non-cash adjustments of $42.8 million, and a net increase in assets and liabilities of $13.2 million. Non-cash items primarily included a loss on extinguishment of debt of $12.0 million, amortization of developed technology of $11.2 million, stock-based compensation expense of $11.4 million, amortization of debt discounts and issuance costs of $1.9 million, depreciation and amortization of $4.6 million, and an intangible asset impairment loss of $0.4 million. The net increase in assets and liabilities was primarily due to lower accrued liabilities for retention bonuses and other variable compensation.

Net cash used in operating activities in 2018 was $25.2 million and consisted of net loss of $59.0 million less non-cash adjustments of $37.3 million, and a net increase in assets and liabilities of $3.5 million. Non-cash items primarily included amortization of developed technology of $11.2 million, stock-based compensation expense of $11.0 million, and depreciation and amortization of $5.4 million. The net increase in assets and liabilities was primarily due to lower accrued liabilities for retention bonuses.

Net cash used in operating activities in 2017 was $24.1 million and consisted of net loss of $60.5 million less non-cash adjustments of $27.7 million, and a net reduction in assets and liabilities of $8.8 million. Non-cash items primarily included amortization of developed technology of $11.2 million, stock-based compensation of $9.1 million and depreciation and amortization of $7.4 million. The net change in assets and liabilities was primarily driven by a decrease in inventory, an increase in deferred revenue, an increase in other liabilities and a decrease in prepaid expenses and other current assets.

Net Cash Provided by (Used in) Investing Activities

Our primary investing activities consist of purchases, sales, and maturities of our short-term investments and to a much lesser extent, capital expenditures for manufacturing, laboratory, computer equipment and software to support our infrastructure and work force. We expect to continue to incur costs for capital expenditures to improve manufacturing efficiencies and strengthen information technology and network security, as well as capital expenditures incurred in moving our corporate headquarters in 2020. However, we may choose to decrease or defer certain capital expenditures and development activities, while further optimizing our organization.

Net cash used in investing activities in 2019 was $39.3 million, which included purchases of investments of $62.4 million offset by proceeds from sales and maturities of investments of $25.6 million, and capital expenditures of $2.5 million to support our business and manufacturing operations.

Net cash provided by investing activities in 2018 was $4.7 million, which included proceeds from sales and maturities of investments of $6.5 million, offset by purchases of investments of $1.5 million and capital expenditures of $0.4 million to support our commercial and manufacturing operations.

Net cash provided by investing activities in 2017 was $17.7 million, which included proceeds from sales and maturities of investments of $25.6 million, offset by purchases of investments of $6.3 million and capital expenditures of $1.6 million to support our commercial and manufacturing operations.

Net Cash Provided by Financing Activities

We generated cash from financing activities of $2.8 million during 2019. $51.8 million of proceeds from a new $55.0 million debt issuance were used to retire 2014 Notes, as discussed below in more detail. Payments of debt and equity issuance costs of $1.9 million were partially offset by cash inflows from equity programs. We generated cash from financing activities of $57.7 million during 2018. Approximately $59.5 million was generated from a public offering of our common stock. The remainder reflects the proceeds from stock option exercises and ESPP purchases, offset by debt and equity issuance costs and payments of taxes for the net settlement of equity awards. We generated cash from financing activities of $29.0 million during 2017, primarily due to a public equity offering.

Capital Resources

At December 31, 2019 and December 31, 2018, our working capital, excluding deferred revenues and restricted cash, was $74.0 million and $101.0 million, respectively, including cash and cash equivalents of $21.7 million and $95.4 million, respectively, and short-term investments of $37.0 million and nil, respectively.

In February 2014, we closed an underwritten public offering of $201.3 million in aggregate principal amount of our 2014 Notes. In March 2018, we entered into privately negotiated transactions with certain holders of our 2014 Notes to exchange $150.0 million in aggregate principal amount of the 2014 Notes for $150.0 million in aggregate principal amount of 2018 Notes. Following the exchange transactions, approximately $51.3 million in aggregate principal amount of 2014 Notes remained outstanding.

In the first quarter of 2019, we received notices from holders of the 2018 Notes electing to voluntarily convert approximately $138.1 million in aggregate principal amount of the 2018 Notes. In February 2019, we notified trustee U.S. Bank National Association of our intention to exercise our issuer's conversion option with respect to the remaining approximately $11.9 million in aggregate principal amount of 2018 Notes. In total, $150.0 million of the 2018 Notes were converted into approximately 19.5 million shares of our common stock and the 2018 Notes were retired.

In November 2019, we closed a private placement to qualified institutional buyers pursuant to Rule 144A under the Securities Act of $55.0 million aggregate principal amount of 2019 Notes. Net proceeds of the 2019 Notes issuance were $52.7 million, after deductions for commissions and other debt issuance costs. $51.8 million of the proceeds was used to retire $50.2 million aggregate principal amount of our 2014 Notes, leaving approximately $1.1 million of aggregate principal amount of our 2014 Notes outstanding. The remaining cash proceeds from the issuance of the 2019 Notes will be used for general corporate purposes. Pursuant to the Indenture governing the 2014 Notes, holders of the 2014 Notes have the right, subject to certain conditions specified in such indenture, to require the Company to purchase their 2014 Notes beginning in February 2021. The private placement of the 2019 Notes, and concurrent repurchase of a portion of the 2014 Notes, had the effect of refinancing a portion of the Company's outstanding debt under the 2014 Notes to December 2024.

The 2019 Notes bear interest at 5.25% per annum, payable semiannually on June 1 and December 1 of each year, beginning on June 1, 2020. The Notes will mature on December 1, 2024, unless earlier repurchased or converted pursuant to their terms. The 2019 Notes will be convertible at the option of the holder at any point prior to close of business on the second scheduled trading day preceding the maturity date. The initial conversion rate of the Notes is 344.8276 shares of the Company's common stock per $1,000 principal amount of 2019 Notes (which is equivalent to an initial conversion price of approximately $2.90 per share). The conversion rate will be subject to adjustment upon the occurrence of certain specified events but will not be adjusted for any accrued and unpaid interest.

The 2019 Notes will also be convertible at our option upon certain conditions in accordance with the terms of the indenture governing the 2019 Notes. On or after December 1, 2021 to December 1, 2022, if the price of the Company's common stock has equaled or exceeded 150% of the Conversion Price (as defined in the indenture, currently $2.90, subject to adjustment) for a specified number of days (Issuer's Conversion Option), we may, at our option, elect to convert the 2019 Notes in whole but not in part into shares of the Company, determined in accordance with the terms of the indenture. On or after December 1, 2022, if the price of the Company's common stock has equaled or exceeded 130% of the Conversion Price then in effect for a specified number of days, we may, at its option, elect to convert the 2019 Notes in whole but not in part into shares of the Company, determined in accordance with the terms of the indenture.

The foregoing summaries of the 2014 Notes, the 2018 Notes, the 2019 Notes and the exchange transactions completed in March 2018 and November 2019 are not complete and are qualified in their entirety by the applicable indentures, forms of global notes, and other agreements and documents filed with the SEC.

On August 2, 2018, we entered into a Revolving Credit Facility with Silicon Valley Bank, which matures on August 2, 2020. Amounts drawn under the Revolving Credit Facility will be used for working capital and general corporate purposes. As of December 31, 2019, total availability under the Revolving Credit Facility was $8.9 million. We currently have no outstanding debt under the Revolving Credit Facility, and we are in compliance with all the terms and conditions of the loan agreement governing the Revolving Credit Facility. See Note 6 to our consolidated financial statements for more information about the Revolving Credit Facility.

We believe our existing cash, cash equivalents, and investments will be sufficient to meet our working capital and capital expenditure needs for at least the next 18 months. However, we may experience lower than expected cash generated from operating activities or greater than expected capital expenditures, cost of revenue, or operating expenses, and we may need to raise additional capital to fund our operations, further our research and development activities, or acquire or invest in a business. Our future funding requirements will depend on many factors, including market acceptance of our products, the cost of our research and development activities, the cost of filing and prosecuting patent applications, the cost associated with litigation or disputes relating to intellectual property rights or otherwise, the cost and timing of regulatory clearances or approvals, if any, the cost and timing of establishing additional sales, marketing, and distribution capabilities, the cost and timing of establishing additional technical support capabilities, and the effect of competing technological and market developments. In the future, we may acquire businesses or technologies from third parties, and we may decide to raise additional capital through debt or equity financing to the extent we believe this is necessary to successfully complete these acquisitions.

If we require additional funds in the future, we may not be able to obtain such funds on acceptable terms, or at all. If we raise additional funds by issuing equity securities, our stockholders could experience dilution. Debt financing, if available, may involve covenants restricting our operations or our ability to incur additional debt. Any additional 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 delay development or commercialization of our products or license to third parties the rights to commercialize products or technologies that we would otherwise seek to commercialize. We also may have to reduce marketing, customer support, research and development, or other resources devoted to our products.

Off-Balance Sheet Arrangements

Since our inception, we have not had any off-balance sheet arrangements as defined in Item 303(a)(4) of the SEC's Regulation S-K.

Contractual Obligations and Commitments

The following summarizes our contractual obligations as of December 31, 2019 (in thousands):

	Payments Due by Period				
	Total	Less than 1 Year	1-3 Years	3-5 Years	Thereafter
Long-term debt obligations	$ 70,957	$ 2,917	$ 5,835	$ 60,835	$ 1,370
Commenced operating lease obligations, net	6,813	1,926	2,322	1,474	1,091
Future operating lease obligations (1)	61,101	2,727	11,030	11,816	35,528
Purchase obligations	2,239	2,239	—	—	—
Total	$ 141,110	$ 9,809	$ 19,187	$ 74,125	$ 37,989

(1) This relates to a new lease agreement signed during 2019 for our new corporate headquarters that will begin in the first quarter of 2020.

Debt obligations include the principal amount of the Notes and interest payments to be made under the Notes. Although the 2014 and 2019 Notes mature in 2034 and 2024, respectively, they can be converted into shares of our common stock prior to maturity if certain conditions are met. See Note 6 to our consolidated financial statements for additional information regarding the terms of the Notes.

Our commenced operating lease obligations, net of sublease income, relate to leases for our current corporate headquarters and leases for manufacturing and office space for our foreign subsidiaries. Purchase obligations consist of contractual and legally binding commitments to purchase goods and services.

We currently lease facilities and equipment under non-cancellable lease agreements expiring at various times through 2027. Our lease payments are expensed on a straight-line basis over the life of the leases. Rental expense under operating leases, net of amortization of lease incentive, totaled $6.1 million, $5.0 million, and $4.7 million for 2019, 2018, and 2017, respectively.

In December 2019, we entered into a Sales and Purchase Agreement with the shareholders of InstruNor AS, a privately held Norwegian company (InstruNor), to purchase all of the outstanding shares of InstruNor. The purchase price was approximately $5.2 million in cash and 485,451 shares of our stock, with a fair value of $2.0 million, based on the closing price of our stock on the closing date. The transaction closed in January 2020.

We have entered into several license and patent agreements. Under these agreements, we pay annual license maintenance fees, non-refundable license issuance fees, and royalties as a percentage of net sales for the sale or sublicense of products using the licensed technology. Future payments related to these license agreements have not been included in the contractual obligations table above as the period of time over which the future license payments will be required to be made, and the amount of such payments, are indeterminable. We do not expect the license payments to be material in any particular year.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Market risk represents the risk of loss that may impact our financial position due to adverse changes in financial market prices and rates. Our market risk exposure is primarily a result of fluctuations in foreign currency exchange rates and interest rates. We do not hold or issue financial instruments for trading purposes.

Foreign Currency Exchange Risk

As we expand internationally our results of operations and cash flows will become increasingly subject to fluctuations due to changes in foreign currency exchange rates. Our revenue is generally denominated in the local currency of the contracting party. Historically, the majority of our revenue has been denominated in U.S. dollars. Our expenses are generally denominated in the currencies in which our operations are located, which is primarily in the United States, with a portion of expenses incurred in Singapore and Canada where our manufacturing facilities are located. Our results of operations and cash flows are, therefore, subject to fluctuations due to changes in foreign currency exchange rates. The volatility of exchange rates depends on many factors that we cannot forecast with reliable accuracy. We have experienced and will continue to experience fluctuations in our net income or loss as a result of transaction gains or losses related to revaluing certain current asset and current liability balances that are denominated in currencies other than the functional currency of the entities in which they are recorded. For the year ended December 31, 2019, we had a foreign currency gain of $0.1 million compared to a foreign exchange loss of $0.1 million in the prior year. To date, we have not entered into any foreign currency hedging contracts although we may do so in the future. As our international operations grow, we will continue to reassess our approach to manage our risk relating to fluctuations in currency rates. If foreign currency exchange rates had changed by 10% during the periods presented, it would not have had a material impact on our financial position or results of operations.

Interest Rate Sensitivity

We had cash and cash equivalents of $21.7 million as of December 31, 2019. These amounts were held primarily in cash on deposit with banks and money market funds which are short-term. We also held $37.0 million of investments in treasury securities at December 31, 2019. Cash, cash equivalents and investments are held for working capital purposes. We believe that we do not have any material exposure to changes in the fair value of our money market portfolio as a result of changes in interest rates. Declines in interest rates, however, will reduce future investment income. If overall interest rates had decreased by 10% during the periods presented, our interest income would not have been materially affected.

Fair Value of Financial Instruments

We do not have material exposure to market risk with respect to investments. We do not use derivative financial instruments for speculative or trading purposes. We may adopt specific hedging strategies in the future.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

Index to Consolidated Financial Statements

Report of Independent Registered Public Accounting Firm

To the Board of Directors and
Stockholders of Fluidigm Corporation

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of Fluidigm Corporation and its subsidiaries (the “Company”) as of December 31, 2019 and 2018, and the related consolidated statements of operations, of comprehensive loss, of stockholders’ equity, and of cash flows for each of the three years in the period ended December 31, 2019, including the related notes and financial statement schedule listed in the accompanying index (collectively referred to as the “consolidated financial statements”). We also have audited the Company's internal control over financial reporting as of December 31, 2019, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2019 and 2018, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2019 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2019, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the COSO.

Changes in Accounting Principles

As discussed in Note 2 to the consolidated financial statements, the Company changed the manner in which it accounts for leases in 2019 and the manner in which it accounts for revenue from contracts with customers in 2018.

Basis for Opinions

The Company’s management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in Management’s Report on Internal Control Over Financial Reporting appearing under Item 9A. Our responsibility is to express opinions on the Company’s consolidated financial statements and on the Company’s internal control over financial reporting 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 audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

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

2018 Senior Convertible Notes - Estimation of Fair Value of Debt Upon Retirement

As described in Notes 2 and 6 to the consolidated financial statements, in the first quarter of 2019 the Company converted $150 million of the 2018 Senior Convertible Notes into 19.5 million shares of its common stock, which resulted in the recording of a $9 million loss, representing the difference between the fair value of the notes retired and their carrying cost. Management determined the fair value of the convertible notes using valuation techniques that require management to make assumptions related to the implied discount rate.

The principal considerations for our determination that performing procedures relating to the 2018 Senior Convertible Notes - estimation of fair value of debt upon retirement is a critical audit matter are there was significant auditor effort in performing procedures and evaluating the implied discount rate assumption used by management in determining the fair value of the convertible notes. In addition, the audit effort involved the use of professionals with specialized skill and knowledge to assist in performing these procedures and in evaluating the audit evidence obtained from these procedures.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to management's valuation of the convertible notes, including controls over the development of the assumptions related to the implied discount rate. These procedures also included, among others, the involvement of professionals with specialized skill and knowledge to assist in developing an independent estimate of the implied discount rate, and comparison of this independent estimate to management's assumption.

/s/PricewaterhouseCoopers LLP

San Jose, California
February 27, 2020

We have served as the Company's auditor since 2015.

FLUIDIGM CORPORATION

CONSOLIDATED BALANCE SHEETS
(In thousands, except per share amounts)

	December 31,	
	2019	**2018**
ASSETS		
Current assets:		
Cash and cash equivalents	$ 21,661	$ 95,401
Short-term investments	36,978	—
Accounts receivable (net of allowances of $6 and $126, at December 31, 2019 and 2018, respectively)	18,981	16,651
Inventories	13,884	13,003
Prepaid expenses and other current assets	4,592	2,051
Total current assets	96,096	127,106
Property and equipment, net	8,056	8,825
Operating lease right-of-use asset, net	4,860	—
Other non-current assets	5,492	6,208
Developed technology, net	46,200	57,400
Goodwill	104,108	104,108
Total assets	$ 264,812	$ 303,647
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 6,510	$ 4,027
Accrued compensation and related benefits	5,160	14,470
Operating lease liabilities, current	1,833	—
Other accrued liabilities	7,515	7,621
Deferred revenue, current	11,803	11,464
Total current liabilities	32,821	37,582
Convertible notes, net	53,821	172,058
Deferred tax liability	11,494	13,714
Operating lease liabilities, non-current	4,323	—
Deferred revenue, non-current	8,168	6,327
Other non-current liabilities	573	1,850
Total liabilities	111,200	231,531
Commitments and contingencies (Note 14)		
Stockholders' equity:		
Preferred stock, $0.001 par value, 10,000 shares authorized, no shares issued and outstanding at either December 31, 2019 or 2018	—	—
Common stock: $0.001 par value, 200,000 shares authorized at December 31, 2019 and 2018; 69,956 and 49,338 shares issued and outstanding at December 31, 2019 and 2018, respectively	70	49
Additional paid-in capital	777,765	631,605
Accumulated other comprehensive loss	(582)	(687)
Accumulated deficit	(623,641)	(558,851)
Total stockholders' equity	153,612	72,116
Total liabilities and stockholders' equity	$ 264,812	$ 303,647

See accompanying notes

FLUIDIGM CORPORATION

CONSOLIDATED STATEMENTS OF OPERATIONS
(In thousands, except per share amounts)

	Year Ended December 31,		
	2019	2018	2017
Revenue:			
Product revenue	$ 95,416	$ 93,650	$ 84,399
Service revenue	21,277	19,314	17,348
Grant revenue	550	—	—
License revenue	—	—	190
Total revenue	117,243	112,964	101,937
Cost of sales:			
Cost of product revenue	45,461	44,861	45,039
Cost of service revenue	7,503	6,454	4,916
Total cost of sales	52,964	51,315	49,955
Gross profit	64,279	61,649	51,982
Operating expenses:			
Research and development	31,640	30,030	30,826
Selling, general and administrative	84,478	79,783	79,516
Total operating expenses	116,118	109,813	110,342
Loss from operations	(51,839)	(48,164)	(58,360)
Interest expense	(4,279)	(13,893)	(5,824)
Loss from extinguishment of debt	(12,020)	—	—
Other income, net	1,433	637	385
Loss before income taxes	(66,705)	(61,420)	(63,799)
Income tax benefit	1,915	2,407	3,264
Net loss	(64,790)	(59,013)	(60,535)
Net loss per share, basic and diluted	$ (0.97)	$ (1.49)	$ (1.84)
Shares used in computing net loss per share, basic and diluted	66,779	39,652	32,980

See accompanying notes

FLUIDIGM CORPORATION

CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS
(In thousands)

	Year Ended December 31,		
	2019	2018	2017
Net loss	$ (64,790)	$ (59,013)	$ (60,535)
Other comprehensive income (loss), net of tax			
Foreign currency translation adjustment	69	(112)	183
Net change in unrealized gain (loss) on investments	36	(1)	3
Other comprehensive income (loss), net of tax	105	(113)	186
Comprehensive loss	$ (64,685)	$ (59,126)	$ (60,349)

See accompanying notes

FLUIDIGM CORPORATION
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(in thousands)

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Income (Loss)	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount				
Balance at December 31, 2016	29,208	$ 29	$ 493,441	$ (760)	$ (439,477)	$ 53,233
At-the-market offering	9,091	9	28,793	—	—	28,802
Issuance of restricted stock, net of shares withheld for taxes, and other	413	1	(166)	—	—	(165)
Issuance of common stock from option exercises	25	—	100	—	—	100
Issuance of common stock under ESPP	50	—	222	—	—	222
Cumulative-effect of new accounting standard for Topic 718 Stock Compensation	—	—	184	—	(184)	—
Stock-based compensation expense	—	—	9,092	—	—	9,092
Net loss	—	—	—	—	(60,535)	(60,535)
Other comprehensive income (loss), net of taxes	—	—	—	186	—	186
Balance at December 31, 2017	38,787	39	531,666	(574)	(500,196)	30,935
Market offering	9,373	9	59,084	—	—	59,093
Issuance of restricted stock, net of shares withheld for taxes, and other	886	1	(379)	—	—	(378)
Issuance of common stock from option exercises	40	—	208	—	—	208
Issuance of common stock under ESPP	252	—	1,203	—	—	1,203
Conversion option on convertible debt			29,357			29,357
Conversion cost related to conversion option on convertible debt	—	—	(557)	—	—	(557)
Cumulative-effect on new accounting standards for Topic 606 Revenue	—	—	—	—	358	358
Stock-based compensation expense			11,023	—		11,023
Net loss	—	—	—	—	(59,013)	(59,013)
Other comprehensive income (loss), net of taxes	—	—	—	(113)	—	(113)
Balance at December 31, 2018	49,338	49	631,605	(687)	(558,851)	72,116
Issuance of common stock on bond conversion	19,460	19	133,280	—	—	133,299
Issuance of restricted stock, net of shares withheld for taxes, and other	666	1	(601)	—	—	(600)
Issuance of common stock from option exercises	195	—	1,058	—	—	1,058
Issuance of common stock under ESPP	297	1	1,074	—	—	1,075
Stock-based compensation expense		—	11,349	—	—	11,349
Net loss	—	—	—	—	(64,790)	(64,790)
Other comprehensive income (loss), net of taxes	—	—	—	105	—	105
Balance at December 31, 2019	69,956	$ 70	$ 777,765	$ (582)	$ (623,641)	$ 153,612

See accompanying notes

FLUIDIGM CORPORATION

CONSOLIDATED STATEMENTS OF CASH FLOWS
(In thousands)

	Year Ended December 31,		
	2019	2018	2017
Operating activities			
Net loss	$ (64,790)	$ (59,013)	$ (60,535)
Adjustments to reconcile net loss to net cash used in operating activities:			
Depreciation and amortization	4,605	5,372	7,409
Stock-based compensation expense	11,393	11,023	9,092
Amortization of developed technology	11,200	11,200	11,200
Amortization of debt discounts, premiums and issuance costs	1,936	8,379	287
Impairment of intangible	443	—	—
Loss on extinguishment of debt	12,020	—	—
Loss on disposal of property and equipment	89	141	135
Increase in inventory reserves, net	1,449	1,026	434
Other non-cash items	(316)	175	(890)
Changes in assets and liabilities:			
Accounts receivable, net	(2,075)	(1,788)	(554)
Inventories	(2,689)	462	4,162
Prepaid expenses and other assets	(1,400)	178	1,583
Accounts payable	2,145	(294)	585
Deferred revenue	2,129	2,574	1,636
Other liabilities	(11,349)	(4,636)	1,358
Net cash used in operating activities	(35,210)	(25,201)	(24,098)
Investing activities			
Purchases of investments	(62,370)	(1,450)	(6,276)
Proceeds from maturities of investments	25,600	6,541	25,550
Purchases of intangible assets	—	—	(50)
Purchases of property and equipment	(2,531)	(372)	(1,566)
Net cash provided by (used in) investing activities	(39,301)	4,719	17,658
Financing activities			
Proceeds from issuance of common stock	—	59,469	28,793
Proceeds from debt issuance	55,000	—	—
Repayment of long-term debt	(51,826)	—	—
Payments of debt and equity issuance cost	(1,888)	(2,862)	—
Proceeds from exercise of stock options	1,058	208	100
Proceeds from stock issuance from ESPP	1,075	1,203	222
Payments for taxes related to net share settlement of equity awards and other	(629)	(358)	(118)
Net cash provided by financing activities	2,790	57,660	28,997
Effect of foreign exchange rate fluctuations on cash and cash equivalents	56	167	454
Net increase (decrease) in cash, cash equivalents and restricted cash	(71,665)	37,345	23,011
Cash, cash equivalents and restricted cash at beginning of period	95,401	58,056	35,045
Cash, cash equivalents and restricted cash at end of period	$ 23,736	$ 95,401	$ 58,056
Supplemental disclosures of cash flow information			
Cash paid for interest	$ 3,542	$ 5,534	$ 5,534
Cash paid for income taxes, net of refunds	$ 205	$ 321	$ 245
Unpaid debt and equity issuance costs	$ 534	$ 375	$ —
Asset retirement obligations	$ 312	$ 314	$ 203

See accompanying notes

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
December 31, 2019

1. Description of Business

Fluidigm Corporation (the Company, we, our or us) creates, manufactures, and markets technologies and tools for life sciences research, including preparatory and analytical instruments for Mass Cytometry, PCR, Library Prep, Single Cell Genomics, and consumables, including integrated fluidic circuits (IFC), assays, and reagents. Our focus is on the most pressing needs in translational and clinical research, including cancer, immunology and immunotherapy. We sell our instruments, consumables and services to academic institutions, clinical research laboratories, and contract research organizations, as well as biopharmaceutical, biotechnology, and agricultural biotechnology companies. The Company was formerly known as Mycometrix Corporation and changed its name to Fluidigm Corporation in April 2001. Fluidigm Corporation was founded in 1999 and is headquartered in South San Francisco, California.

2. Summary of Significant Accounting Policies

Basis of Presentation and Consolidation

The accompanying consolidated financial statements have been prepared in conformity with U.S. generally accepted accounting principles (U.S. GAAP) and include the accounts of our wholly-owned subsidiaries. As of December 31, 2019, we had wholly-owned subsidiaries in Singapore, Canada, the Netherlands, Japan, France, the United Kingdom, China, and Germany. All subsidiaries, except for Singapore, use their local currency as their functional currency. The Singapore subsidiary uses the U.S. dollar as its functional currency. All intercompany transactions and balances have been eliminated in consolidation.

Certain prior period amounts in the consolidated statements of cash flows were reclassified to conform with the current period presentation. These reclassifications were immaterial and did not affect prior period total assets, total liabilities, stockholders' equity, total revenue, total costs and expenses, loss from operations or net loss.

Use of Estimates

The preparation of financial statements in accordance with U.S. GAAP requires management to make estimates and assumptions that affect the amounts reported in the consolidated financial statements and accompanying notes. We base our estimates on historical experience and on various other assumptions believed to be reasonable, which together form the basis for making judgments about the carrying values of assets and liabilities. Actual results could differ materially from these estimates and could have a material adverse effect on our consolidated financial statements.

Foreign Currency

Assets and liabilities of non-U.S. subsidiaries that use the local currency as their functional currency are translated into U.S. dollars at exchange rates in effect on the balance sheet date. The adjustments resulting from the foreign currency translations are recorded in accumulated other comprehensive loss, a separate component of stockholders’ equity. Income and expense accounts are translated at monthly average exchange rates during the year.

Revenue Recognition

We adopted ASC 606 Revenue from Contracts with Customers on January 1, 2018 and all the related amendments using the modified retrospective method. The Company recognized the cumulative effect of initially applying the new revenue standard as an adjustment to the opening balance of accumulated deficit as of January 1, 2018. The comparative information for 2017 has not been recast and continues to be reported under the accounting standards in effect for that period.

We generate revenue primarily from the sale of our products and services. Product revenue is derived from the sale of instruments and consumables, including IFCs, assays and reagents. Service revenue is derived from the sale of instrument service contracts, repairs, installation, training and other specialized product support services. We receive grants from various entities to perform research and development activities over contractually defined periods. Revenue is generally recognized provided that the conditions under which the grants were provided have been met and any remaining performance obligations are perfunctory. Revenue is reported net of any sales, use and value-added taxes we collect from customers as required by government authorities.

We recognize revenue based on the amount of consideration we expect to receive in exchange for the goods and services we transfer to the customer. Our commercial arrangements typically include multiple distinct products and services, and we allocate revenue to these performance obligations based on their relative standalone selling prices. Standalone selling prices (SSP) are generally determined using observable data from recent transactions. In cases where sufficient data is not available, we estimate a product's SSP using a cost plus a margin approach or by applying a discount to the product's list price.

Product Revenue

We recognize product revenue at the point in time when control of the goods passes to the customer and we have an enforceable right to payment. This generally occurs either when the product is shipped from one of our facilities or when it arrives at the customer's facility, based on the contractual terms. Customers generally do not have a unilateral right to return products after delivery. Invoices are generally issued at shipment and generally become due in 30 to 60 days.

We sometimes perform shipping and handling activities after control of the product passes to the customer. We have made an accounting policy election to account for these activities as product fulfillment activities rather than as separate performance obligations.

Service Revenue

We recognize revenue from repairs, maintenance, installation, training and other specialized product support services at the point in time the work is completed. Installation and training services are generally billed in advance of service. Repairs and other services are generally billed at the point the work is completed.

Revenue associated with instrument service contracts is recognized on a straight-line basis over the life of the agreement, which is generally one to three years. We believe this time-elapsed approach is appropriate for service contracts because we provide services on demand throughout the term of the agreement. Invoices are generally issued in advance of service on a monthly, quarterly, annual or multi-year basis. Payments made in advance of service are reported on our consolidated balance sheet as deferred revenue.

Contract Costs

Incremental sales commission costs incurred to obtain instrument service contracts are capitalized and amortized to selling, general and administrative expense over the life of the contract, which is generally one to three years. As a practical expedient, we expense sales commissions associated with product support services that are delivered in less than one year as they are incurred. Sales commissions associated with the sale of products are expensed as they are incurred. To date, capitalized contract costs have been immaterial.

Product Warranties

We generally provide a one-year warranty on our instruments. We accrue for estimated warranty obligations at the time of product shipment. We periodically review our warranty liability and record adjustments based on the terms of warranties provided to customers, and historical and anticipated warranty claim experience. This expense is recorded as a component of cost of product revenue in the consolidated statements of operations.

Significant Judgments

Applying the revenue recognition practices discussed above often requires significant judgment. Judgment is required when identifying performance obligations, estimating SSP and allocating purchasing consideration in multi-element arrangements and estimating the future amount of our warranty obligations. Moreover, significant judgment is required when interpreting commercial terms and determining when control of goods and services passes to the customer. Any material changes created by errors in judgment could have a material effect on our operating results and overall financial condition.

Cash and Cash Equivalents

We consider all highly liquid financial instruments with maturities at the time of purchase of three months or less to be cash equivalents. Cash and cash equivalents may consist of cash on deposit with banks, money market funds, and notes from government-sponsored agencies.

Investments

Short-term investments are comprised of notes from government-sponsored agencies that mature within one year. All investments are recorded at estimated fair value. Any unrealized gains and losses from investments are reported in accumulated other comprehensive loss, a separate component of stockholders' equity. We evaluate our investments to assess whether investments with unrealized loss positions are other-than-temporarily impaired. An investment is considered to be other-than-temporarily impaired if the impairment is related to deterioration in credit risk or if it is likely that we will sell the securities before the recovery of their cost basis. No investment has been assessed as other than temporarily impaired, and realized gains and losses were immaterial during the years presented. The cost of securities sold, or the amount reclassified out of accumulated other comprehensive income into earnings is based on the specific-identification method.

Accounts Receivable

Trade accounts receivable are recorded at net invoice value. We review our exposure to accounts receivable and provide allowances of specific amounts if collectability is no longer reasonably assured based on historical experience and specific customer collection issues. We evaluate such allowances on a regular basis and adjust them as needed.

Concentrations of Business and Credit Risk

Financial instruments that potentially subject us to credit risk consist of cash, cash equivalents, investments, and accounts receivable. Our cash, cash equivalents, and investments may consist of deposits held with banks, money market funds, and other highly liquid investments that may at times exceed federally insured limits. Cash equivalents and investments are financial instruments that potentially subject us to concentrations of risk. Under our investment policy, we invest primarily in securities issued by the U.S. government. The goals of our investment policy, in order of priority, are as follows: preserve capital, meet liquidity needs, and optimize returns.

We generally do not require collateral to support credit sales. To reduce credit risk, we perform credit evaluations of our customers. No single customer represented more than 10% of total revenue for 2019, 2018, or 2017, and no single customer represented more than 10% of total accounts receivable at December 31, 2019, 2018, or 2017.

Our products include components that are currently procured from a single source or a limited number of sources. We believe that other vendors would be able to provide similar components; however, the qualification of such vendors may require start-up time. In order to mitigate any adverse impacts from a disruption of supply, we attempt to maintain an adequate supply of critical limited-source components.

Inventories

Inventories are stated at the lower of cost (on a first-in, first-out basis) or net realizable value. Inventory costs include direct materials, direct labor, and normal manufacturing overhead. Finished goods that are used for research and development are expensed as consumed or depreciated over their period of use. Provisions for slow-moving, excess, and obsolete inventories are recorded when required to reduce inventory values to their estimated net realizable values based on product life cycle, development plans, product expiration, and quality issues.

Property and Equipment

Property and equipment, including leasehold improvements, are stated at cost less accumulated depreciation. Accumulated depreciation is calculated using the straight-line method over the estimated useful lives of the assets. Leasehold improvements are amortized over the estimated useful lives of the assets or the remaining term of the lease, whichever is shorter. The estimated useful lives of our property and equipment are generally as follows: computer equipment and software, three to four years; laboratory and manufacturing equipment, two to five years; and office furniture and fixtures, five years.

Depreciation expense for the years ended December 31, 2019, 2018, and 2017 was $3.6 million, $4.2 million, and $5.9 million, respectively.

Goodwill, Intangible Assets and Other Long-Lived Assets

Goodwill, which has an indefinite useful life, represents the excess of cost over fair value of net assets acquired. Our intangible assets include developed technology, patents and licenses. The cost of identifiable intangible assets with finite lives is generally amortized on a straight-line basis over the assets' respective estimated useful lives.

Goodwill and intangible assets with indefinite lives are not subject to amortization but are tested for impairment on an annual basis during the fourth quarter or whenever events or changes in circumstances indicate the carrying amount of these assets may not be recoverable. Events or changes in circumstances that could affect the likelihood that we will be required to recognize an impairment charge include, but are not limited to, declines in our stock price or market capitalization, declines in our market share or revenues, and an increase in our losses, rapid changes in technology, failure to achieve the benefits of capacity increases and utilization, significant litigation arising out of an acquisition, or other matters. Any impairment charges could have a material adverse effect on our operating results and net asset value in the quarter in which we recognize the impairment charge.

In evaluating our goodwill and intangible assets with indefinite lives for indications of impairment, we first conduct an assessment of qualitative factors to determine whether it is more likely than not that the fair value of our reporting unit is less than its carrying amount. If we determine that it is more likely than not that the fair value of our reporting unit is less than its carrying amount, we then conduct a two-step test for impairment of goodwill. In the first step, we compare the fair value of our reporting unit to its carrying value. If the fair value of our reporting unit exceeds its carrying value, goodwill is not considered impaired and no further analysis is required. If the carrying value of the reporting unit exceed its fair value, then the second step of the impairment test must be performed in order to determine the implied fair value of the goodwill. If the carrying value of the goodwill exceeds its implied fair value, then an impairment loss equal to the difference would be recorded. We did not recognize any impairment of goodwill for any of the periods presented herein.

We evaluate our long-lived assets, including finite-lived intangibles, for indicators of possible impairment when events or changes in circumstances indicate the carrying amount of an asset may not be recoverable. If any indicator of impairment exists, we assess the recoverability of the affected long-lived assets by determining whether the carrying value of the asset can be recovered through undiscounted future operating cash flows. If impairment is indicated, we estimate the asset's fair value using future discounted cash flows associated with the use of the asset and adjust the carrying value of the asset accordingly. In the fourth quarter of 2019, we recognized an impairment charge of $0.4 million on patents and licenses that are not used in current products and are not expected to be used in future product offerings.

Convertible Notes

In February 2014, we closed an underwritten public offering of $201.3 million aggregate principal amount of our 2.75% Senior Convertible Notes due 2034 (2014 Notes). In March 2018, we entered into separate privately negotiated transactions with certain holders of our 2014 Notes to exchange $150.0 million in aggregate principal amount of the 2014 Notes for our 2.75% Exchange Convertible Senior Notes due 2034 (2018 Notes). As the 2018 Notes were convertible, at our election, into cash, shares of our common stock, or a combination of cash and shares of our common stock, we accounted for the 2018 Notes under the cash conversion guidance in ASC 470, whereby the embedded conversion option in the 2018 Notes was separated and accounted for in equity. The embedded conversion option value was calculated as the difference between (i) the total fair value of the 2018 Notes and (ii) the fair value of a similar debt instrument excluding the embedded conversion option. We determined an embedded conversion option value of $29.3 million, which was recorded in additional paid-in-capital and reduced the carrying value of the 2018 Notes. The resulting discount on the 2018 Notes was amortized over the expected term of the 2018

Notes, using the effective interest method through the first note holder put date, of February 6, 2023. In the first quarter of 2019, the 2018 Notes were converted into 19.5 million shares of our common stock and the 2018 Notes were retired. We recorded a loss of $9.0 million on the retirement of the 2018 Notes. We have determined the fair value of the 2018 Notes using valuation techniques that require us to make assumptions related to the implied discount rate.

In November 2019, we closed a private placement to qualified institutional buyers pursuant to Rule 144A under the Securities Act of $55.0 million aggregate principal amount of our 5.25% Senior Convertible Notes due 2024 (2019 Notes). The majority of the issuance proceeds were used to retire approximately $50.2 million of aggregate principal amount of our 2014 Notes, leaving approximately $1.1 million of aggregate principal amount of our 2014 Notes outstanding. We recorded a loss of $3.0 million on the extinguishment of the 2014 Notes. This amount represents the difference between the fair value of the 2019 Notes used to extinguish the debt and the carrying value of the 2014 Notes, including unamortized debt issuance costs.

As the 2019 Notes do not provide for a cash conversion feature, the 2019 Notes are recorded for as debt in their entirety in accordance with ASC 470. For the 2014, 2018 and 2019 Notes, offering-related costs, including underwriting costs, were capitalized as debt issuance costs, recorded as an offset to the carrying value of the related Notes, and are amortized over the expected term of the related Notes using the effective interest method.

See Note 6 for a detailed discussion of the accounting treatment of the transactions and additional information.

Fair Value of Financial Instruments

Our financial instruments consist primarily of cash and cash equivalents, restricted cash, investments, accounts receivable, accounts payable, and convertible notes. Our cash equivalents, restricted cash, investments, accounts receivable, and accounts payable generally have short maturity or payment periods. Accordingly, their carrying values approximated their fair values at December 31, 2019 and 2018. The convertible notes are presented at their carrying value, with fair value disclosures made in Note 8. As a basis for considering fair value, we follow a three-tier value hierarchy, which prioritizes the inputs used in measuring fair value as follows:

Level I: observable inputs such as quoted prices in active markets;
Level II: inputs other than quoted prices in active markets that are observable either directly or indirectly; and
Level III: unobservable inputs for which there is little or no market data, which requires us to develop our own assumptions.

This hierarchy requires us to use observable market data, when available, and to minimize the use of unobservable inputs when determining fair value. Our cash equivalents, which include money market funds, are classified as Level I because they are valued using quoted market prices. Our investments and convertible notes are generally classified as Level II because their value is based on valuations using significant inputs derived from or corroborated by observable market data. Depending on the security, the income and market approaches are used in the model driven valuations. Inputs of these models include recently executed transaction prices in securities of the issuer or comparable issuers and yield curves.

Research and Development

We recognize research and development expenses in the period incurred. Research and development expenses consist of personnel costs, independent contractor costs, prototype and materials expenses, allocated facilities and information technology expenses, and related overhead expenses.

Advertising Costs

We expense advertising costs as incurred. We incurred advertising costs of $3.4 million, $2.2 million and $1.8 million during 2019, 2018, and 2017, respectively.

Income Taxes

We use the asset and liability method to account for income taxes. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to temporary differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. Valuation allowances are provided when the expected realization of deferred tax assets does not meet a "more likely than not" criterion. We make estimates and judgments about our future taxable income that are based on assumptions that are consistent with our plans and estimates. Should the actual amounts differ from our estimates, the amount of our valuation allowance could be materially impacted. Changes in these estimates may result in significant increases or decreases to our tax provision in a period in which such estimates are changed, which in turn would affect net income or loss.

We recognize the financial statement effects of a tax position when it is more likely than not, based on the technical merits, that the position will be sustained upon examination. Any interest and penalties related to uncertain tax positions are reflected in the income tax provision.

Stock-Based Compensation

We account for stock options and restricted stock units granted to employees and directors and stock purchases under ESPP based on the fair value of the awards. We recognize stock-based compensation expense on a straight-line basis over the requisite service periods for non-performance-based awards. For performance-based stock awards, stock-based compensation expense is recognized over the requisite service period when the achievement of each individual performance goal becomes probable.

Comprehensive Loss

Comprehensive loss is comprised of net loss and other comprehensive income (loss). Other comprehensive income (loss) consists of unrealized gains and losses on our investments and foreign currency translation adjustments. Total comprehensive loss for all periods presented has been disclosed in the consolidated statements of comprehensive loss.

The components of accumulated other comprehensive loss, net of tax, for the years ended December 31, 2019, 2018, and 2017 are as follows (in thousands):

	Foreign Currency Translation Adjustment	Unrealized Gain (Loss) on Investments	Accumulated Other Comprehensive Income (Loss)
Ending balance at December 31, 2017	$ (575)	$ 1	$ (574)
Change during the year	(112)	(1)	(113)
Ending balance at December 31, 2018	(687)	—	(687)
Change during the year	69	36	105
Ending balance at December 31, 2019	$ (618)	$ 36	$ (582)

Immaterial amounts of unrealized gains and losses have been reclassified into the consolidated statement of operations for the years ended December 31, 2019, 2018 and 2017.

Net Loss per Share

Our basic and diluted net loss per share is calculated by dividing net loss by the weighted-average number of shares of common stock outstanding for the period. Restricted stock units, performance share units, and stock options to purchase our common stock are considered to be potentially dilutive common shares but have been excluded from the calculation of diluted net loss per share as their effect is anti-dilutive for all periods presented.

The following potentially dilutive common shares were excluded from the computations of diluted net loss per share for the periods presented because including them would have been anti-dilutive (in thousands):

	December 31,		
	2019	2018	2017
Stock options, restricted stock units and performance awards	5,189	4,354	3,501
2019 Convertible Notes	18,966	—	—
2019 Convertible Notes potential make-whole shares	3,182	—	—
2018 Convertible Notes	—	19,035	—
2018 Convertible Notes potential make-whole shares	—	757	—
2014 Convertible Notes	19	916	3,598
Total	27,356	25,062	7,099

Recent Accounting Changes and Accounting Pronouncements

Adoption of New Accounting Guidance

In February 2016, the FASB established Topic 842, Leases, by issuing Accounting Standards Update (ASU) No. 2016-02, which requires lessees to recognize operating leases on the balance sheet and disclose key information about leasing arrangements. Topic 842 was subsequently amended by ASU No. 2018-01, Land Easement Practical Expedient for Transition to Topic 842; ASU No. 2018-10, Codification Improvements to Topic 842, Leases; and ASU No. 2018-11, Targeted Improvements. The new standard establishes a right-of-use (ROU) model that requires a lessee to recognize a ROU asset and lease liability on the balance sheet for all leases with a term longer than 12 months. Leases are classified as finance or operating; the classification will impact the expense recognition in the income statement.

Modified Retrospective Transition approach is required, applying the new standard to all leases existing at the date of initial application. An entity may choose to use either (1) its effective date or (2) the beginning of the earliest comparative period presented in the financial statements as its date of initial application. We adopted the new standard on January 1, 2019 and used the effective date of the standard as our date of initial application. Consequently, previously presented financial information has not been updated, and the disclosures required under the new standard have not been provided for dates and periods before January 1, 2019. For dates and periods prior to January 1, 2019, the original disclosures under ASC 840 are disclosed.

The new standard provides several optional practical expedients in transition. We elected the 'package of practical expedients,' which permits us to not reassess under the new standard our prior conclusions about lease identification, lease classification and initial direct costs. We did not elect the use-of-hindsight or the practical expedient pertaining to land easements; the latter not being applicable to us.

On adoption, we recognized $9.2 million of lease liabilities, based on the present value of the current minimum lease payments, discounted using our collateralized incremental borrowing rate, with corresponding ROU assets of $7.4 million. The difference between the initial lease liability and ROU asset is attributable to deferred rent. There was no impact to accumulated deficit from the adoption of ASC 842.

The new standard also provides certain accounting elections for an entity's ongoing accounting. We elected the short-term lease recognition exemption for all leases that qualify. This means that, for those leases that qualify, we will not recognize ROU assets or lease liabilities for leases with an initial lease term of one year or less. We also elected to not separate lease and nonlease components for our building leases. The nonlease components are generally variable in nature and are expected to represent most of our variable lease costs. Variable costs are expensed as incurred. We have taken a portfolio approach for our vehicle leases by country. We determine whether an arrangement is a lease, or contains a lease, at inception.

Recent Accounting Pronouncements

In November 2019, the FASB issued ASU 2019-12-Income Taxes (Topic 740): Simplifying the Accounting for Income Taxes. The amendments in this update improve consistent application of and simplifies GAAP for Topic 740 by clarifying and amending existing guidance including intra-period allocation, reporting tax law changes and losses in interim periods, state and local taxes not fully based on income and recognition of deferred tax liability related to certain transactions. There is also new guidance related to consolidated group reporting and tax impacts resulting from business combinations. The new guidance is effective for fiscal years beginning after December 15, 2020. We are currently evaluating the impact of adoption on our consolidated financial statements.

In August 2018, the FASB issued ASU 2018-15-Intangibles-Goodwill and Other-Internal-Use Software (Subtopic 350-40) which establishes new guidance on the accounting for costs incurred to implement a cloud computing arrangement that is considered a service arrangement. The new guidance requires the capitalization of such costs, aligning it with the accounting for costs associated with developing or obtaining internal-use software. The new guidance is effective for fiscal years beginning after December 15, 2019. The adoption of the new guidance is not expected to have a significant impact on our financial results.

In January 2017, the FASB issued ASU 2017-04, Intangibles-Goodwill and Other (Topic 350): Simplifying the Test for Goodwill Impairment. The ASU eliminates the requirement for an entity to calculate the implied fair value of goodwill to measure a goodwill impairment charge. Instead, an entity performs its annual, or interim, goodwill impairment testing by comparing the fair value of a reporting unit with its carrying amount and recording an impairment charge for the amount by which the carrying amount exceeds the fair value. The ASU will be effective for annual and interim goodwill impairment testing performed for our fiscal year beginning January 1, 2020, with early adoption permitted. The adoption of the new guidance is not expected to have a significant impact on our financial results.

The FASB issued two ASUs related to financial instruments – credit losses. The ASUs issued were: (1) in June 2016, ASU 2016-13, Financial Instruments-Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments, and (2) in November 2018, ASU 2018-19-Codification Improvements to Topic 326, Financial Instruments-Credit Losses. ASU 2016-13 is intended to improve financial reporting by requiring more timely recording of credit losses on loans and other financial instruments held by financial institutions and other organizations. ASU 2018-19 clarifies that receivables arising from operating leases are not within the scope of the credit losses standard, but rather, should be accounted for in accordance with the leasing standard. These ASUs are effective for fiscal years beginning after December 15, 2019, and interim periods within those years, with early adoption permitted. The modified retrospective method is required upon adoption. The adoption of the new guidance is not expected to have a significant impact on our financial results.

3. Revenue

Disaggregation of Revenue

The following table presents our revenue for the year ended December 31, 2019, 2018, and 2017, respectively, based on geographic area and by source (in thousands):

	Year Ended December 31,		
	2019	2018	2017
Geographic Markets:			
Americas	$ 47,016	$ 51,172	$ 49,290
EMEA	40,024	36,617	32,642
Asia-Pacific	30,203	25,175	20,005
Total	$ 117,243	$ 112,964	$ 101,937

	Year Ended December 31,		
	2019	2018	2017
Source:			
Instruments	$ 50,004	$ 45,491	$ 42,505
Consumables	45,412	48,159	41,894
Product revenue	95,416	93,650	84,399
Services	21,277	19,314	17,348
Grant	550	—	—
License	—	—	190
Total	$ 117,243	$ 112,964	$ 101,937

Performance Obligations

We reported $17.8 million of deferred revenue on our December 31, 2018 consolidated balance sheet. During the twelve months ended December 31, 2019, $10.7 million of the opening balance was recognized as revenue and $12.9 million of net additional advance payments were received from customers, primarily associated with instrument service contracts. At December 31, 2019, we reported $20.0 million of deferred revenue.

The following table summarizes the expected timing of revenue recognition for unfulfilled performance obligations associated with instrument service contracts that were partially completed at December 31, 2019 (in thousands):

Fiscal Year	Expected Revenue [1]
2020	$ 10,733
2021	6,403
2022	3,516
Thereafter	2,081
Total	$ 22,733

[1] Expected revenue includes both billed amounts included in deferred revenue and unbilled amounts that are not reflected in our consolidated financial statements and are subject to change if our customers decide to cancel or modify their contracts. Purchase orders for instrument service contracts can generally be canceled before the service period begins without penalty.

We apply the practical expedient that permits us to not disclose information about unsatisfied performance obligations for service contracts with an expected term of one year or less.

4. Goodwill and Intangible Assets, net

In connection with our acquisition of DVS in February 2014, we recognized goodwill of $104.1 million. Intangible assets include developed technology related to the DVS acquisition and other intangible assets are included in other non-current assets.

Intangible assets, net, were as follows (in thousands):

	December 31, 2019			
	Gross Amount	Accumulated Amortization	Net	Weighted-Average Amortization Period
Developed technology	$ 112,000	$ (65,800)	$ 46,200	10.0 years
Patents and licenses	$ 11,274	$ (8,342)	$ 2,932	7.8 years

	December 31, 2018			
	Gross Amount	Accumulated Amortization	Net	Weighted-Average Amortization Period
Developed technology	$ 112,000	$ (54,600)	$ 57,400	10.0 years
Patents and licenses	$ 11,274	$ (6,861)	$ 4,413	7.8 years

In the fourth quarter of 2019, we concluded that one of our patents and licenses was impaired and reduced its carrying value to zero, recognizing a charge of $0.4 million, which is reflected in accumulated amortization. Total amortization expense for the years ended December 31, 2019, December 31, 2018, and December 31, 2017 was $12.2 million, $12.3 million and $12.4 million, respectively.

Based on the carrying value of intangible assets, net, as of December 31, 2019, the annual amortization expense is expected to be as follows (in thousands):

Fiscal Year	Developed Technology Amortization Expense	Patents and Licenses Amortization Expense	Total
2020	$ 11,200	$ 916	$ 12,116
2021	11,200	761	11,961
2022	11,200	677	11,877
2023	11,200	571	11,771
2024	1,400	7	1,407
Thereafter	—	—	—
Total	$ 46,200	$ 2,932	$ 49,132

5. Balance Sheet Details

Cash, Cash Equivalents and Restricted Cash

Cash, cash equivalents and restricted cash consisted of the following as of December 31, 2019 and 2018 (in thousands):

	December 31,	
	2019	2018
Cash and cash equivalents	$ 21,661	$ 95,401
Restricted cash	2,075	—
Total cash, cash equivalents and restricted cash	$ 23,736	$ 95,401

Short-term restricted cash of approximately $1.1 million is included in prepaid expenses and other current assets, and $1.0 million of non-current restricted cash is included in other non-current assets in the consolidated balance sheet.

Inventories

Inventories consisted of the following as of December 31, 2019 and 2018 (in thousands):

	December 31,	
	2019	2018
Raw materials	$ 6,133	$ 5,996
Work-in-process	659	650
Finished goods	7,092	6,357
Total inventories	$ 13,884	$ 13,003

Property and Equipment, net

Property and equipment consisted of the following as of December 31, 2019 and 2018 (in thousands):

	December 31,	
	2019	2018
Computer equipment and software	$ 3,997	$ 4,201
Laboratory and manufacturing equipment	19,325	18,780
Leasehold improvements	7,788	7,173
Office furniture and fixtures	1,824	1,506
Property and equipment, gross	32,934	31,660
Less accumulated depreciation and amortization	(24,954)	(22,855)
Construction-in-progress	76	20
Property and equipment, net	$ 8,056	$ 8,825

Warranties

Activity for our warranty accrual for the years ended December 31, 2019 and 2018, which are included in other accrued liabilities, is summarized below (in thousands):

	Year Ended December 31,	
	2019	2018
Beginning balance	$ 863	$ 699
Accrual for current period warranties	1,386	1,573
Warranty costs incurred	(859)	(1,409)
Ending balance	$ 1,390	$ 863

6. Convertible Notes and Credit Facility

2014 Senior Convertible Notes (2014 Notes)

On February 4, 2014, we closed an underwritten public offering of $201.3 million aggregate principal amount of our 2.75% Senior Convertible Notes due 2034 (2014 Notes) pursuant to an underwriting agreement, dated January 29, 2014. The 2014 Notes will mature on February 1, 2034, unless earlier converted, redeemed, or repurchased in accordance with the terms of the 2014 Notes.

The initial conversion rate of the 2014 Notes is 17.8750 shares of our common stock, par value $0.001 per share, per $1,000 principal amount of 2014 Notes (which is equivalent to an initial conversion price of approximately $55.94 per share). Holders may surrender their 2014 Notes for conversion at any time prior to the stated maturity date. On or after February 6, 2018, and prior to February 6, 2021, we may redeem any or all of the 2014 Notes in cash if the closing price of our common stock exceeds 130% of the conversion price for a specified number of days, and on or after February 6, 2021, we may redeem any or all of the 2014 Notes in cash without any such condition. The redemption price of the 2014 Notes will equal 100% of the principal amount of the 2014 Notes plus accrued and unpaid interest. Holders may require us to repurchase all or a portion of their 2014 Notes on each of February 6, 2021, February 6, 2024, and February 6, 2029, at a repurchase price in cash equal to 100% of the principal amount of the 2014 Notes plus accrued and unpaid interest. If we undergo a fundamental change, as defined in the terms of the 2014 Notes, holders may require us to repurchase the 2014 Notes in whole or in part for cash at a repurchase price equal to 100% of the principal amount of the 2014 Notes plus accrued and unpaid interest.

In February 2014, we received $195.2 million, net of underwriting discounts, from the issuance of the 2014 Notes and incurred approximately $1.1 million in offering-related expenses. The underwriting discount of $6.0 million and the debt issuance costs of $1.1 million were recorded as offsets to the proceeds. The underwriting discount and offering-related expenses are being amortized to interest expense using the effective-interest rate method. The effective interest rate on the 2014 Notes, reflecting the impact of debt discounts and issuance costs, is 3.0%.

We have retired the majority of the 2014 Notes through the issuance of the 2018 Notes and 2019 Notes, below discussed. As of December 31, 2019, there is $1.1 million aggregate principal of the 2014 Notes outstanding.

2018 Senior Convertible Notes (2018 Notes)

In March 2018, we entered into separate privately negotiated transactions with certain holders of our 2014 Notes to exchange $150.0 million in aggregate principal amount of the 2014 Notes for 2018 Notes, leaving $51.3 million of aggregate principal amount of 2014 Notes outstanding. As of the closing of the 2018 Notes on March 12, 2018, the estimated fair value was $145.5 million. The difference between the $150.0 million aggregate principal amount of the 2018 Notes and its fair value was being amortized over the expected term of the 2018 Notes using the effective interest method through the first note holder put date of February 6, 2023.

We accounted for the exchange transaction as an extinguishment of debt due to the significance of the change in value of the embedded conversion option, resulting in a $0.1 million gain. The gain on extinguishment of debt was calculated as the difference between the reacquisition price (i.e., the fair value of the principal amount of 2018 Notes) and the net carrying value of the 2014 Notes exchanged, net of unamortized debt discount and debt issuance cost write-offs.

The 2018 Notes accrued interest at a rate of 2.75%, payable semi-annually in arrears on February 1 and August 1 of each year. The 2018 Notes matured on February 1, 2034, unless earlier converted, redeemed, or repurchased in accordance with the terms of the indenture governing the 2018 Notes. The initial conversion rate of the 2018 Notes was 126.9438 shares of our common stock, par value $0.001 per share, per $1,000 principal amount of the 2018 Notes (which is equivalent to an initial conversion price of approximately $7.88 per share). The conversion rate was subject to adjustment upon the occurrence of certain specified events. Those certain specified events included holders who convert their 2018 Notes voluntarily prior to our exercise of the issuer's conversion option described below or in connection with a make-whole fundamental change prior to February 6, 2023, entitling the holders, under certain circumstances, to a make-whole premium in the form of an increase in the conversion rate determined by reference to a make-whole table set forth in the indenture governing the 2018 Notes. Any time prior to the maturity of the 2018 Notes, we could convert the 2018 Notes, in whole but not in part, into cash, shares of our common stock, or combination thereof, if the closing price of our common stock equaled or exceeded 110% of the conversion price then in effect for a specified number of days. On or after February 6, 2022, we could elect to redeem all or any portion of the 2018 Notes at a redemption price equal to 100% of the accreted principal amount of the 2018 Notes on the redemption date of the 2018 Notes, plus accrued and unpaid interest.

Holders of the 2018 Notes had the right, at their option, to require us to purchase all or a portion of the 2018 Notes (i) on February 6, 2023, February 6, 2026, and February 6, 2029, or (ii) in the event of a fundamental change, as defined in the indenture governing the 2018 Notes, in each case, at a repurchase price equal to 100% of the accreted principal amount (i.e., up to 120% of the outstanding principal amount) of the 2018 Notes on the fundamental change repurchase date, plus accrued and unpaid interest.

Offering-related costs for the 2018 Notes were approximately $2.8 million. Offering-related costs of $2.2 million were capitalized as debt issuance costs, recorded as an offset to the carrying value of the 2018 Notes, and were being amortized over the expected term of the 2018 Notes using the effective interest method through the first note holder put date of February 6, 2023. The effective interest rate on the 2018 Notes was 12.3%.

Offering-related costs of $0.6 million were accounted for as equity issuance costs, recorded as an offset to additional paid-in capital, and were not subject to amortization. Offering-related costs were allocated between debt and equity in the same proportion as the allocation of the 2018 Notes between debt and equity.

In the first quarter of 2019, we received notices from holders of the 2018 Notes electing to voluntarily convert approximately $138.1 million in aggregate principal amount of the 2018 Notes. In February 2019, we notified trustee U.S. Bank National Association of our intention to exercise our issuer's conversion option with respect to the remaining approximately $11.9 million in aggregate principal amount of 2018 Notes. In total, $150.0 million of the 2018 Notes were converted into 19.5 million shares of our common stock and the bonds were retired. We recognized a loss of $9.0 million on the retirement of the 2018 Notes, which represents the difference between the fair value of the bonds retired and their carrying costs. The net impact on equity was $133.3 million and represents the fair value of the bonds retired.

2019 Senior Convertible Notes (2019 Notes)

In November 2019, we issued $55.0 million aggregate principal amount of 2019 Notes. Net proceeds of the 2019 Notes issuance were $52.7 million, after deductions for commissions and other debt issuance costs. Offering related costs were capitalized as debt issuance costs, recorded as an offset to the carrying value of the 2019 Notes and are being amortized over the expected term of the 2019 Notes using the effective interest method. The effective interest rate on the 2019 Notes is 6.2%.

$51.8 million of the proceeds of the 2019 Notes was used to retire $50.2 million aggregate principal amount of our 2014 Notes. We accounted for the transaction as an extinguishment of debt due to the significance of the change in value of the embedded conversion option, resulting in a $3.0 million loss. The loss on extinguishment of debt was calculated as the difference between the reacquisition price (i.e., the fair value of the principal amount of 2019 Notes) and the net carrying value of the 2014 Notes exchanged.

The 2019 Notes bear interest at 5.25% per annum, payable semiannually on June 1 and December 1 of each year, beginning on June 1, 2020. The Notes will mature on December 1, 2024, unless earlier repurchased or converted pursuant to their terms. The 2019 Notes will be convertible at the option of the holder at any point prior to the close of business on the second scheduled trading day preceding the maturity date. The initial conversion rate of the Notes is 344.8276 shares of the Company's common stock per $1,000 principal amount of 2019 Notes (which is equivalent to an initial conversion price of approximately $2.90 per share). The conversion rate is subject to adjustment upon the occurrence of certain specified events. Those certain specified events include voluntary conversion of the 2019 Notes prior to our exercise of the Issuer's Conversion Option or in connection with a make-whole fundamental change, entitling the holders, under certain circumstances, to a make-whole premium in the form of an increase in the conversion rate determined by reference to a make-whole table set forth in the indenture governing the 2019 Notes. The conversion rate will not be adjusted for any accrued and unpaid interest.

The 2019 Notes will also be convertible at our option upon certain conditions in accordance with the terms of the indenture governing the 2019 Notes. On or after December 1, 2021 to December 1, 2022, if the price of the Company's common stock has equaled or exceeded 150% of the Conversion Price then in effect for a specified number of days (Issuer's Conversion Option), we may, at our option, elect to convert the 2019 Notes in whole but not in part into shares of the Company, determined in accordance with the terms of the indenture. On or after December 1, 2022, if the price of the Company's common stock has equaled or exceeded 130% of the Conversion Price then in effect for a specified number of days, we may, at our option, elect to convert the 2019 Notes in whole but not in part into shares of the Company, determined in accordance with the terms of the indenture.

Offering-related costs for the 2019 Notes were approximately $2.3 million and were capitalized as debt issuance costs, recorded as an offset to the carrying value of the 2019 Notes, and are being be amortized over the expected term of the 2019 Notes using the effective interest method through the maturity date of December 1, 2024.

The carrying values of the components of the 2014 Notes, 2018 Notes and 2019 Notes are as follows (in thousands):

	December 31, 2019	December 31, 2018
2.75% 2014 Notes due 2034		
Principal amount	$ 1,079	$ 51,250
Unamortized debt discount	(18)	(1,232)
Unamortized debt issuance cost	(4)	(224)
	$ 1,057	$ 49,794
2.75% 2018 Notes due 2034		
Principal amount	$ —	$ 149,999
Premium accretion	—	3,755
Unamortized debt discount	—	(29,558)
Unamortized debt issuance cost	—	(1,932)
	$ —	$ 122,264
5.25% 2019 Notes due 2024		
Principal amount	$ 55,000	$ —
Unamortized debt issuance cost	(2,236)	—
	$ 52,764	$ —
Net carrying value of all Notes	$ 53,821	$ 172,058

2018 Revolving Credit Facility

On August 2, 2018, we entered into a revolving credit facility with Silicon Valley Bank (Revolving Credit Facility) in an aggregate principal amount of up to the lesser of (i) $15.0 million (Maximum Amount) or (ii) the sum of (a) 85% of our eligible receivables and (b) 50% of our eligible inventory, in each case, subject to certain limitations (Borrowing Base), provided that the amount of eligible inventory that may be counted towards the Borrowing Base shall be subject to a cap as set forth in the Revolving Credit Facility. Subject to the level of this borrowing base, we may make and repay borrowings from time to time until the maturity of the revolving credit facility. The borrowing base as of December 31, 2019 under the revolving credit facility was $8.9 million. There were no borrowings outstanding under the Revolving Credit Facility at December 31, 2019.

The Revolving Credit Facility matures on August 2, 2020, and is collateralized by substantially all our property, other than intellectual property. Outstanding loans under the Revolving Credit Facility will bear interest, at the greater of (i) prime rate plus 0.50% or (ii) 5.50%. Interest on any outstanding loans is due and payable monthly and the principal balance is due at maturity though loans can be prepaid at any time without penalty. In addition, we pay a quarterly unused revolving line facility fee of 0.75% per annum on the average unused facility.

Subject to certain exceptions, we must pay a prepayment fee equal to (i) 2.00% of the Maximum Amount if it prepays all advances and terminates the Loan Agreement prior to August 2, 2019, or (ii) 1.00% of the Maximum Amount if it prepays all advances and terminates the Loan Agreement on or after August 2, 2019, and prior to the maturity date.

We incurred approximately $335,000 of debt issuance costs in connection with the facility, including $225,000 in commitment fees. Half of the commitment fee was paid at the inception of the facility and the remainder was paid on August 2, 2019. Debt issuance costs were capitalized and are being amortized to interest expense over the life of the Revolving Credit Facility.

The Revolving Credit Facility contains customary affirmative and negative covenants which, unless waived by the bank, limit our ability to, among other things, incur additional indebtedness, grant liens, make investments, repurchase stock, pay dividends, transfer assets, enter into affiliate transactions, undergo a change of control, or engage in merger and acquisition activity, including merging or consolidating with a third party. The Revolving Credit Facility also contains customary events of default, subject to customary cure periods for certain defaults, that include, among other things, non-payment defaults, covenant defaults, material judgment defaults, bankruptcy and insolvency defaults, cross-defaults to certain other material indebtedness, and defaults due to inaccuracy of representation and warranties. Upon an event of default, the lender may declare all or a portion of the outstanding obligations payable by us to be immediately due and payable and exercise other rights and remedies provided for under the Revolving Credit Facility. During the existence of an event of default, interest on the obligations under the Revolving Credit Facility could be increased to 5.0% above the otherwise applicable rate of interest.

We were in compliance with all the terms and conditions of the Revolving Credit Facility at December 31, 2019.

7. Leases

We have operating leases for buildings, equipment and vehicles. Existing leases have remaining terms of less than one year to eight years. Some leases contain options to extend the lease, usually for up to five years, and termination options.

Operating lease right-of-use assets, net, consisted of the following (in thousands):

	December 31, 2019		
	Gross Amount	**Accumulated Amortization**	**Net**
Operating lease right-of-use buildings	$ 6,234	$ (1,618)	$ 4,616
Operating lease right-of-use equipment	69	(34)	35
Operating lease right-of-use vehicles	355	(146)	209
Total	$ 6,658	$ (1,798)	$ 4,860

In the first half of 2019, we entered into a new operating lease for our corporate headquarters in South San Francisco, California, which is expected to commence in March 2020. The lease term is approximately 10 years. Future minimum lease payments over the life of the lease are expected to be approximately $61.1 million.

The components of lease expense were:

(in thousands)	**Twelve months ended December 31, 2019**
Operating lease cost (including variable costs)	$ 6,093
Variable costs including non-lease component	$ 2,624
Supplemental information:	
Cash paid for amounts included in the measurement of operating lease liabilities (included in net cash used in operating activities)	
Operating cash flows from operating leases	$ 4,008

	December 31, 2019
Weighted average remaining lease term (in years)	4.7
Weighted average discount rate	5.0%

Future minimum lease payments and minimum sublease income under commenced non-cancelable operating leases, which are as of December 31, 2019 as follows (in thousands):

Fiscal Year	Minimum Lease Payments for Operating Leases	Minimum Sublease Income	Net Amount
2020	$ 2,058	$ (132)	$ 1,926
2021	1,371	—	1,371
2022	951	—	951
2023	733	—	733
2024	741	—	741
Thereafter	1,091	—	1,091
Total future minimum payments (income)	$ 6,945	$ (132)	$ 6,813
Less: imputed interest	(789)		
Total	$ 6,156		

December 31, 2019	
Operating lease liabilities, current	$ 1,833
Operating lease liabilities, non-current	4,323
Total	$ 6,156

Disclosures related to periods prior to adoption of ASC 842

Operating lease rent expense, net of amortization of lease incentives and sublease income was $5.0 million and $4.7 million for the twelve months ended December 31, 2018 and 2017, respectively, for the comparative prior years before the adoption of ASC 842.

As of December 31, 2018, future minimum lease payment obligations and minimum sublease income, net of expenses, under noncancelable operating leases before the adoption of ASC 842 were disclosed as follows (in thousands):

Fiscal Year	Minimum Lease Payments for Operating Leases	Minimum Sublease Income	Net Amount
2019	$ 4,184	$ (520)	$ 3,664
2020	2,213	(164)	2,049
2021	1,245	—	1,245
2022	827	—	827
2023	552	—	552
Thereafter	1,241	—	1,241
Total future minimum payments (income)	$ 10,262	$ (684)	$ 9,578

8. Fair Value of Financial Instruments

The following tables summarize our cash and available-for-sale securities that were measured at fair value by significant investment category within the fair value hierarchy (in thousands):

	December 31, 2019						
	Amortized Cost	Gross Unrealized Gain	Gross Unrealized Loss	Fair Value	Cash and Cash Equivalents	Short-Term Marketable Securities	Cash-Restricted
Assets:							
Cash	$ 16,614	$ —	$ —	$ 16,614	$ 16,614	$ —	$ —
Cash-restricted	2,075	—	—	2,075	—	—	2,075
Total cash	$ 18,689	$ —	$ —	$ 18,689	$ 16,614	$ —	$ 2,075
Available-for-sale:							
Level I:							
Money market funds	$ 5,047	$ —	$ —	$ 5,047	$ 5,047	$ —	$ —
U.S. treasury securities	36,942	36	—	36,978	—	36,978	—
Subtotal	$ 41,989	$ 36	$ —	$ 42,025	$ 5,047	$ 36,978	$ —
Total	$ 60,678	$ 36	$ —	$ 60,714	$ 21,661	$ 36,978	$ 2,075

	December 31, 2018					
	Amortized Cost	Gross Unrealized Gain	Gross Unrealized Loss	Fair Value	Cash and Cash Equivalents	Short-Term Marketable Securities
Assets:						
Cash	$ 17,685	$ —	$ —	$ 17,685	$ 17,685	$ —
Available-for-sale:						
Level I:						
Money market funds	$ 77,716	$ —	$ —	$ 77,716	$ 77,716	$ —
U.S. treasury securities	—	—	—	—	—	—
Subtotal	$ 77,716	$ —	$ —	$ 77,716	$ 77,716	$ —
Total	$ 95,401	$ —	$ —	$ 95,401	$ 95,401	$ —

There were no transfers between Level I and Level II measurements, and no changes in the valuation techniques used during the years ended December 31, 2019, and 2018.

Based on an evaluation of securities that were in a loss position, we did not recognize any other-than-temporary impairment charges for the years ended December 31, 2019, 2018, and 2017. None of our investments have been in a continuous loss position for more than 12 months. We concluded that the declines in market value of our available-for-sale securities investment portfolio were temporary in nature and did not consider any of our investments to be other-than-temporarily impaired.

Convertible Notes

For 2018, the estimated fair value of the 2014 and 2018 Notes was based on a market approach and represents a Level II valuation. When determining the estimated fair value of our long-term debt, we used a commonly accepted valuation methodology and market-based risk measurements that are indirectly observable, such as credit risk. In 2019, we significantly reduced the amount of our debt outstanding. As a result, these securities are not traded frequently, so it is difficult to estimate a reliable and accurate market price and represent Level III valuations. A fair value for these assets cannot be determined by using readily observable inputs or measures, such as market prices or models. Fair values were estimated using pricing models and risk-adjusted value ranges.

The following table summarizes the par value, carrying value and the estimated fair value of the 2014, 2018 and 2019 Notes at December 31, 2019 and 2018, respectively (in thousands):

	December 31, 2019			December 31, 2018		
	Par Value	Carrying Value	Fair Value	Par Value	Carrying Value	Fair Value
2014 Notes	$ 1,079	$ 1,057	$ 1,122	$ 51,250	$ 49,794	$ 43,665
2018 Notes	—	—	—	149,999	122,264	171,843
2019 Notes	55,000	52,764	73,975	—	—	—
Total	$ 56,079	$ 53,821	$ 75,097	$201,249	$172,058	$215,508

9. Shareholders' Equity

Conversion of 2018 Notes

In the first quarter of 2019, we issued 19,460,260 shares of our common stock in connection with the conversion of our 2018 Notes (see Note 6). As a result of this issuance of our common stock, we recorded a total of $133.3 million of equity, which is equivalent to the fair value of the bonds retired.

2018 Market Offering

On December 14, 2018, we closed on an underwritten public offering of 9,372,500 shares our common stock, $0.001 par value. The common stock was sold at a price to the public of $6.75 per share, for aggregate gross proceeds of approximately $63.3 million, from our existing shelf registration statement. Net proceeds from the offering were approximately $59.1 million after deducting underwriting discounts and commissions of $3.8 million and the $0.4 million of estimated expenses of the offering. We intend to use the net proceeds of the offering for general corporate purposes, including working capital, capital expenditures and continued research and development with respect to products and technologies, and to fund possible investments in or acquisitions of complementary businesses, products, or technologies.

2017 At-the-Market Offering

On August 10, 2017, we sold 9,090,909 shares of our common stock, $0.001 par value per share, pursuant to an earlier Sales Agreement, for aggregate gross proceeds of $30.0 million. Our aggregate net proceeds were approximately $28.8 million, after deducting related expenses, including commissions of approximately $0.7 million and issuance costs of approximately $0.5 million. These sales fully exhausted the shares that were available for sale under the Sales Agreement.

Tax Benefit Preservation Plan

On August 1, 2017, the Tax Benefit Preservation Plan (Tax Plan) dated as of November 21, 2016 expired and all of the preferred share purchase rights distributed to the holders of our common stock pursuant to the Tax Plan expired.

At December 31, 2019, we had reserved shares of common stock for future issuance under equity compensation plans as follows:

(in 000's)	Securities To Be Issued Upon Exercise Of Options	Securities To Be Issued Upon Release Of Restricted Stock and Performance Share Units	Number Of Remaining Securities Available For Future Issuance
2009 Equity Incentive Plan	28	—	—
2011 Equity Incentive Plan	1,769	2,829	5,312
DVS Sciences Inc. 2010 Equity Incentive Plan	23	—	—
2017 Inducement Award Plan	207	332	—
2017 Employee Stock Purchase Plan	—	—	401
	2,027	3,161	5,713

10. Stock-Based Plans

Our board of directors sets the terms, conditions, and restrictions related to our ESPP and the grant of stock options, RSUs and performance-based awards under our various stock-based plans. Our board of directors determines the number of awards to grant and also sets vesting criteria.

In general, RSUs vest on a quarterly basis over a period of four years from the date of grant at a rate of 25% on the first anniversary of the grant date and ratably each quarter over the remaining 12 quarters, subject to the employees' continued employment.

Incentive stock options and non-statutory stock options granted under the 2011 Plan have a term of no more than ten years from the date of grant and an exercise price of at least 100% of the fair market value of the underlying common stock on the date of grant. If a participant owns stock representing more than 10% of the voting power of all classes of our stock on the grant date, an incentive stock option awarded to the participant will have a term of no more than five years from the date of grant and an exercise price of at least 110% of the fair market value of the underlying common stock on the date of grant. Generally, options vest at a rate of either 25% on the first anniversary of the option grant date and ratably each month over the remaining period of 36 months, or ratably each month over 48 months. We may grant options with different vesting terms from time to time.

For performance-based share awards, our board of directors sets the performance objectives and other vesting provisions in determining the number of shares or value of performance units and performance shares that will be paid out. Such payout will be a function of the extent to which performance objectives or other vesting provisions have been achieved.

2011 Equity Incentive Plan

On January 28, 2011, our board of directors adopted the 2011 Equity Incentive Plan (the 2011 Plan) under which incentive stock options, non-statutory stock options, restricted stock units (RSUs), stock appreciation rights, performance units, and performance shares may be granted to our employees, directors, and consultants. In April 2019, our board of directors authorized, and in June 2019, our stockholders approved, the amendment and restatement of the 2011 Plan to make various changes, including increasing the number of shares reserved for issuance by approximately 5.0 million shares and extending the term of the 2011 Plan until April 2029.

2009 Equity Incentive Plan and 1999 Stock Option Plan

Our 2009 Equity Incentive Plan (the 2009 Plan) terminated on the date the 2011 Plan was adopted. Options granted, or shares issued under the 2009 Plan that were outstanding on the date the 2011 Plan became effective, remained subject to the terms of the 2009 Plan.

2017 Inducement Award Plan

On January 5, 2017, we adopted the Fluidigm Corporation 2017 Inducement Award Plan (Inducement Plan) and reserved 2 million shares of our common stock for issuance pursuant to equity awards granted under the Inducement Plan. The Inducement Plan provides for the grant of equity-based awards and its terms are substantially similar to the 2011 Plan. In accordance with Rule 5635(c)(4) of the Nasdaq Listing Rules, awards under the Inducement Plan may only be made to individuals not previously our employees or non-employee members of our board of directors (or following such individual's bona fide period of non-employment), as an inducement material to the individual's entry into employment with us or in connection with a merger or acquisition, to the extent permitted by Rule 5635(c)(3) of the Nasdaq Listing Rules. In June 2019, concurrently with the increase in shares available for grant under the 2011 Plan, the Inducement Plan was terminated such that no further grants could be made thereunder. Options granted and shares issued under the Inducement Plan that were outstanding when the Inducement Plan was terminated remain outstanding subject to their terms and the terms of the Inducement Plan.

Valuation and Expense Information

We use the Black-Scholes option-pricing model to estimate the fair value of stock options granted under our equity incentive plans. The weighted average assumptions used to estimate the fair value were as follows:

	Year Ended December 31,		
	2019	2018	2017
Stock options:			
Weighted average expected volatility	69.5%	68.4%	65.0%
Weighted average expected term	4.3 years	4.7 years	4.2 years
Weighted average risk-free interest rate	1.9%	2.7%	1.7%
Dividend yield	—	—	—
Weighted-average fair value per share	$ 7.17	$ 3.45	$ 2.97

We determine the expected volatility based on our historical stock price volatility generally commensurate with the estimated expected term of the stock awards. The expected term of an award is based on historical forfeiture experience, exercise activity, and the terms and conditions of the stock awards. The risk-free interest rate is based on the U.S. Treasury yield in effect at the time of grant for zero coupon U.S. Treasury notes with maturities approximately equal to each grant's expected life. Each of these inputs is subjective and generally requires significant judgment by us. The fair value of the underlying common stock is also required to compute the fair value calculation of options and ESPP. We account for forfeitures as they occur.

We grant stock options at exercise prices not less than the fair value of our common stock at the date of grant. The fair value of RSUs granted to employees was estimated on the date of grant by multiplying the number of shares granted by the fair market value of our common stock on the grant date.

Activity under the 2011 Plan, the 2009 Plan, the 1999 Plan, and the Inducement Plan is as follows:

Restricted Stock Units:

	Number of Units (in 000's)	Weighted-Average Grant Date Fair Value per Unit
Balance at December 31, 2016	1,065	$ 15.31
RSU granted	916	$ 5.73
RSU released	(445)	$ 15.57
RSU forfeited	(368)	$ 13.11
Balance at December 31, 2017	1,168	$ 8.55
RSU granted	1,822	$ 5.98
RSU released	(945)	$ 9.63
RSU forfeited	(233)	$ 8.50
Balance at December 31, 2018	1,812	$ 7.09
RSU granted	1,808	$ 8.08
RSU released	(730)	$ 8.06
RSU forfeited	(339)	$ 7.80
Balance at December 31, 2019	2,551	$ 7.43

The total intrinsic value of RSUs vested and released during the year ended December 31, 2019, 2018 and 2017 were approximately $5.8 million, $6.8 million and $2.3 million, respectively. The intrinsic value of vested and released RSUs is calculated by multiplying the fair market value of our common stock on the vesting date by the number of shares vested. As of December 31, 2019, the unrecognized compensation costs related to outstanding unvested RSUs under our equity incentive plans were $15.9 million. We expect to recognize those costs over a weighted average period of 3.1 years.

2018 Retention Bonus Program

Included in the 2018 RSU activity are 379,593 of grants and releases related to a retention bonus program. As disclosed in our Current Report on Form 8-K filed on February 10, 2017, we previously implemented a company-wide retention bonus incentive program in which our executive officers at the time also participated. The bonus program provides for the payment of cash bonuses to program participants who were employees at the time the plan was implemented and who remain with Fluidigm through January 1, 2019. On September 18, 2018, the compensation committee of our board of directors approved an exchange program for our executive officers and for employees resident in the United States and Canada who are retention bonus program participants. In the exchange program, eligible participants could elect to surrender their right to receive a cash bonus in exchange for fully vested restricted stock units issued under our 2011 Equity Incentive Plan on the terms described below. Among other reasons, our compensation committee adopted the exchange program to encourage employee stock ownership and to effectively manage cash resources.

In connection with the bonus exchange program, each eligible employee could elect to exchange 25%, 50%, 75%, or 100% of the retention cash bonus otherwise payable under the terms of the program. Each employee participating in the exchange would receive a number of fully vested restricted stock units equal to the quotient, rounded up to the next whole number, determined by dividing the cash amount of the retention cash bonus that such eligible employee elects to exchange by an amount equal to 85% of the lower of the closing prices of one share of our common stock on the commencement date of the exchange offer or the closing date of the exchange offer. The exchange offer closed on November 5, 2018. The total value of the 379,593 shares of common stock issued under this program was $2.8 million and is included in the total intrinsic value of RSUs released in 2018.

***Stock Options*:**

	Number of Options (000's)	Weighted-Average Exercise Price per Option	Weighted-Average Remaining Contractual Life (in Years)	Aggregate Intrinsic Value (1) in (000's)
Balance at December 31, 2016	3,560	$ 16.62	6.8	
Options granted	1,364	$ 5.61		
Options exercised	(25)	$ 4.07		$ 42
Option forfeited	(2,735)	$ 16.33		
Balance at December 31, 2017	2,164	$ 10.41	6.6	
Options granted	758	$ 6.05		
Options exercised	(40)	$ 5.24		$ 81
Option forfeited	(497)	$ 16.09		
Balance at December 31, 2018	2,385	$ 7.56	7.8	
Options granted	50	$ 13.08		
Options exercised	(197)	$ 5.43		$ 1,198
Option forfeited	(211)	$ 8.73		
Balance at December 31, 2019	2,027	$ 7.78	6.8	$ 81
Vested at December 31, 2019	1,357	$ 8.61	6.2	$ 69
Unvested awards at December 31, 2019	670	$ 6.08	8.0	$ 12

(1) Aggregate intrinsic value as of December 31, 2019 was calculated as the difference between the closing price per share of our common stock on the last trading day of 2019, which was $3.48, and the exercise price of the options, multiplied by the number of in-the-money options.

As of December 31, 2019, the unrecognized compensation costs related to outstanding unvested options under our equity incentive plans were $2.2 million. We expect to recognize those costs over a weighted average period of 1.8 years.

2017 Stock Option Exchange

Included in the 2017 option activity above is the impact of our 2017 Stock Option Exchange Program. On August 23, 2017, we launched a one-time Stock Option Exchange Program (the Program), which eligible employees were able to exchange certain outstanding stock options (Eligible Options), whether vested or unvested, with an exercise price greater than $4.37 per share and greater than the closing price of a share of our common stock on the Nasdaq Global Select Market on the expiration date of the exchange offer (the Offer), for restricted stock units or stock options (New Awards) covering a lesser number of shares than were subject to the Eligible Options exchanged immediately before being canceled in the Offer. Non-employee members of our board of directors were not eligible to participate in the Program. The Program expired on September 20, 2017, with a closing price of $5.13 per share.

Employees elected to surrender Eligible Options to purchase a total of 1,204,198 shares of our common stock. All surrendered options were canceled effective as of the expiration date, and immediately thereafter, in exchange for such surrendered options, we issued (i) new options to purchase an aggregate of 399,117 shares of our common stock with an exercise price of $5.13; and (ii) restricted stock units representing 54,944 shares of our common stock, each, pursuant to the terms of the Offer and our 2011 Equity Incentive Plan. The new awards granted under the Program generally vest over three years.

The Program did not result in a material incremental stock-based compensation expense because the fair value of the new awards was approximately equal to the fair value of the surrendered options immediately prior to the exchange date. The original fair value of the surrendered options plus the incremental stock-based compensation expense is being recognized over the vesting periods of the New Awards.

Performance-based Awards

Performance Stock Units with Market Conditions

During the twelve months ended December 31, 2019 and 2018, we granted performance stock units to certain executive officers and senior level employees. The number of performance stock units ultimately earned under these awards is calculated based on the Total Shareholder Return (TSR) of our common stock as compared to the TSR of a defined group of peer companies during the applicable three-year performance period. The percentage of performance stock units that vest will depend on our relative position at the end of the performance period and can range from 0% to 200% of the number of units granted.

Under FASB ASC Topic 718, the provisions of the performance stock unit awards related to TSR are considered a market condition, and the effects of that market condition are reflected in the grant date fair value of the awards. We used a Monte Carlo simulation pricing model to incorporate the market condition effects at our grant date.

Activity under the performance stock units is as follows:

	Number of Units (in 000's)	Weighted-Average Grant Date Fair Value per Unit
Balance at December 31, 2017	—	$ —
PSU granted	167	$ 10.09
PSU released	—	—
PSU forfeited	(12)	$ 10.09
Balance at December 31, 2018	155	$ 10.09
PSU granted	401	$ 16.90
PSU released	—	$ —
PSU forfeited	(9)	$ 10.09
Balance at December 31, 2019	547	$ 15.09

As of December 31, 2019, the unrecognized compensation costs related to these awards were $5.5 million. We expect to recognize those costs over a weighted average period of 2.0 years.

Performance Stock Units with Performance Conditions

During 2019, we also granted performance stock units to a certain employee. The number of performance stock units that ultimately vest under these awards is dependent on achieving certain discrete operational milestones between September 30, 2019 and December 31, 2020. Activity under these performance stock units is as follows:

	Number of Units (in 000s)	Weighted-Average Grant Date Fair Value per Unit
Balance at December 31, 2018	—	$ —
PSU granted	68	$ 7.05
PSU released	(4)	$ 7.05
PSU forfeited	—	$ —
Balance at December 31, 2019	64	$ 7.05

2017 Employee Stock Purchase Plan

On August 1, 2017, our stockholders approved our 2017 Employee Stock Purchase Plan (ESPP) at the annual meeting of stockholders. Our ESPP offers U.S. and some non-U.S. employees the right to purchase shares of our common stock. Our first ESPP offering period began on October 1, 2017 with a shorter offering period ending on November 30, 2017.

Prior to June 2019, our ESPP program had a six-month offering period, with a new period commencing on the first trading day on or after May 31 and November 30 of each year. Employees were eligible to participate through payroll deductions of up to 10% of their compensation. The purchase price at which shares were sold under the ESPP was 85% of the lower of the fair market value of a share of our common stock on the first day of the offering period or the last day of the offering period.

Effective in June 2019, our ESPP program was amended to offer a twelve-month offering period with two six-month purchase periods beginning on each of May 31 and November 30. Employees are eligible under the amended program to participate through payroll deductions of up to 15% of their compensation. Employees may not purchase more than $25 thousand of stock for any calendar year.

Under the updated program, the purchase price at which shares are sold for the first purchase period is 85% of the lower of the fair market value of a share of our common stock on the first day of the offering period or the last day of the first purchase period. For the second purchase period, the purchase price at which shares are sold is 85% of the lower of the fair market value of the common stock on the first day of the offering period and the last day of the offering period. In the event the fair market value of the common stock at the beginning of the second purchase period is less than the fair market value on the beginning of the offering period, the purchase price for the second offering period is reset to 85% of the lower of the fair value of the common stock at the beginning of the second purchase period and last day of the offering period.

The offering period of June 1, 2019 to May 31, 2020 has two purchase periods, with one ending November 30, 2019 and the other May 31, 2020. As the fair market value of the common stock at November 30, 2019 was lower than the fair value of the common stock at the beginning of the offering period, the purchase price for the second purchase period was reset based on the lower of the November 30, 2019 price and May 31, 2019 price. The resetting of the purchase price is considered to be a modification of the original terms of the award. Under ASC 718, the incremental fair value based on the difference between the fair value of the modified award and the fair value of the original award immediately before it was modified was approximately $0.3 million. This amount is being amortized over the remaining offering period.

Total stock-based compensation expense recognized was as follows (in thousands):

	For the Year Ended December 31,		
	2019	2018	2017
2018 Retention Bonus Program	$ —	$ 2,809	$ —
Options, Performance Share Units, and Restricted Stock Units	10,555	7,716	8,972
Employee Stock Purchase Plan	838	498	120
Total Share-based Compensation	$ 11,393	$ 11,023	$ 9,092

11. Income Taxes

Our loss before income taxes consists of the following (in thousands):

	Year Ended December 31,		
	2019	2018	2017
Domestic	$ (59,900)	$ (47,600)	$ (56,885)
International	(6,805)	(13,820)	(6,914)
Loss before income taxes	$ (66,705)	$ (61,420)	$ (63,799)

Significant components of our benefit for income taxes are as follows (in thousands):

	Year Ended December 31,		
	2019	2018	2017
Current:			
Federal	$ —	$ (27)	$ —
State	(31)	(19)	(17)
Foreign	(568)	(32)	(501)
Total current tax (expense) benefit	(599)	(78)	(518)
Deferred:			
State	—	—	—
Foreign	2,514	2,485	3,782
Total deferred benefit	2,514	2,485	3,782
Total benefit for income taxes	$ 1,915	$ 2,407	$ 3,264

Reconciliation of income taxes at the statutory rate to the benefit from income taxes recorded in the statements of operations is as follows:

	Year Ended December 31,		
	2019	2018	2017
Tax benefit at federal statutory rate	21.0%	21.0%	34.0%
State tax expense, net of federal benefit	0.9	2.3	5.5
Foreign tax benefit (expense)	(0.1)	(1.1)	0.4
Change in valuation allowance	(6.0)	(19.2)	39.2
Federal research and development credit	0.7	1.5	1.9
Unrecognized tax benefit	(0.1)	(0.2)	(0.6)
Impact of the 2017 Tax Cuts and Jobs Act	—	—	(74.6)
Non-deductible interest/premium	(7.9)	—	—
Global Intangible Low-Tax Income (GILTI)	(5.6)	—	—
Other, net	—	(0.4)	(0.7)
Effective tax rate	2.9%	3.9%	5.1%

At December 31, 2017, we changed our permanent reinvestment assertion and will not permanently reinvest our foreign earnings outside the United States. The cash generated from some of our foreign subsidiaries may be used domestically to fund operations. Any domestic, foreign withholding tax and state taxes that may be due upon future repatriation of earnings is not expected to be significant.

Significant components of our deferred tax assets and liabilities are as follows (in thousands):

	December 31,	
	2019	2018
Deferred tax assets:		
Net operating loss carryforwards	$ 105,702	$ 98,920
Reserves and accruals	3,597	7,167
Depreciation and amortization	3,715	4,262
Tax credit carryforwards	17,267	16,675
Stock-based compensation	2,501	1,899
Total gross deferred tax assets	132,782	128,923
Valuation allowance on deferred tax assets	(130,084)	(126,109)
Total deferred tax assets, net of valuation allowance	2,698	2,814
Deferred tax liabilities:		
Fixed assets and intangibles	(13,899)	(16,528)
Total deferred tax liabilities	(13,899)	(16,528)
Net deferred tax liability	$ (11,201)	$ (13,714)

We evaluate a number of factors to determine the realizability of our deferred tax assets. Recognition of deferred tax assets is appropriate when realization of these assets is more likely than not. Assessing the realizability of deferred tax assets is dependent upon several factors including historical financial results. The net deferred tax assets have been partially offset by a valuation allowance because we have incurred losses since our inception. The valuation allowance increased by $4.0 million and $6.9 million during 2019 and 2018, respectively, and decreased by $27.1 million during 2017. The changes in valuation allowance during 2019 and 2018 are mainly due to significant taxable losses and an increase in tax attributes. The change in valuation allowance during 2019 also includes a release of the valuation allowance against our deferred tax assets in Japan due to achievement of recent profitability and the expectation of future profitability in the jurisdiction, which decreased the valuation allowance by $294 thousand.

The valuation allowances of $130.1 million and $126.1 million as of December 31, 2019 and 2018, respectively, primarily relate to temporary tax differences, net operating losses and research and development credits generated in the current and prior years. We believe it is more likely than not that U.S. federal and state of California deferred tax assets relating to temporary differences, net operating losses and research and development credits are not realizable. As such, full valuation allowances have been applied against the deferred tax assets relating to jurisdictions of the federal U.S. and the state of California.

A reconciliation of the beginning and ending amount of the valuation allowance for the years ended December 31, 2019, 2018, and 2017 is as follows (in thousands):

	Valuation Allowance
December 31, 2016	$ 146,285
Charges to earnings	830
Charges to other accounts	(27,887)
December 31, 2017	119,228
Charges to earnings	—
Charges to other accounts	6,880
December 31, 2018	126,108
Charges to earnings	—
Charges to other accounts	3,976
December 31, 2019	$ 130,084

As of December 31, 2019, we had net operating loss carryforwards for U.S. federal income tax purposes of $470.0 million, which expire beginning in 2020, and U.S. federal research and development tax credits of $9.0 million, which expire in the years 2020 through 2040. As of December 31, 2019, we had net operating loss carryforwards for state income tax purposes of $176.5 million, which expire beginning in 2020 through 2040, and California research and development tax credits of $11.7 million, which do not expire. As of December 31, 2019, we had no foreign net operating loss carryforwards.

Utilization of the net operating loss carryforwards and credits may be subject to a substantial annual limitation due to the ownership change limitations provided by Section 382 of the Internal Revenue Code of 1986, as amended, and similar state provisions. The annual limitation may result in the expiration of net operating losses and credits before utilization. In 2015, we completed a Section 382 analysis for the period from our inception in May 1999 through December 31, 2015, which excluded the net operating loss carryforwards for DVS prior to the acquisition and determined that an ownership change as defined under Section 382 occurred in November 2001, which resulted in a reduction to our U.S. federal net operating losses. In 2019, we continued the Section 382 analysis as historically performed through December 31, 2019 and determined that an ownership change did not occur during the current year.

Uncertain Tax Positions

The aggregate changes in the balance of our gross unrecognized tax benefits during 2019, 2018, and 2017 were as follows (in thousands):

December 31, 2016	$	9,333
Increases in balances related to tax positions taken during current period		61
Decreases in balances related to tax positions taken during prior period		(2,077)
December 31, 2017		7,317
Increases in balances related to tax positions taken during current period		255
Decreases in balances related to tax positions taken during prior period		(228)
December 31, 2018		7,344
Increases in balances related to tax positions during a prior period		155
Increases in balances related to tax positions taken during current period		354
Decreases in balances related to tax positions taken during prior period		(20)
December 31, 2019	$	7,833

Accrued interest and penalties related to unrecognized tax benefits were included in the income tax provision and are immaterial as of December 31, 2019 and 2018.

As of December 31, 2019, there are $0.7 million unrecognized tax benefits that, if recognized, would affect our effective tax rate. We do not anticipate that our existing unrecognized tax benefits will significantly increase or decrease within the next 12 months.

We file income tax returns in the United States, various states, and certain foreign jurisdictions. As a result of net operating loss carryforwards, all of our tax years are open to federal and state examination in the United States. Tax years from 2009 are open to examination in various foreign countries.

12. Employee Benefit Plans

We sponsor a 401(k) savings plan for our employees in the United States that stipulates that eligible employees may elect to contribute to the plan, subject to certain limitations, up to the lesser of 90% of eligible compensation or the maximum amount allowed by the U.S. Internal Revenue Service. In 2015, we implemented a match formula of 100% up to $2,000 annually, following a 4-year vesting schedule. In 2019, the match was increased to up to $3,000 annually. Employer matching contributions to the 401(k) plan for the years ended December 31, 2019, 2018, and 2017 were $0.6 million, $0.4 million, and $0.5 million, respectively.

13. Information About Geographic Areas

We operate in one reporting segment that develops, manufacturers and commercializes tools for life sciences research. Our chief executive officer manages our operations and evaluates our financial performance on a consolidated basis. For purposes of allocating resources and evaluating regional financial performance, our chief executive officer reviews separate sales information for the different regions of the world. Our general and administrative expenses and our research and development expenses are not allocated to any specific region. Most of our principal operations, other than manufacturing, and our decision-making functions are located at our corporate headquarters in the United States.

A summary table of our total revenue by geographic areas of our customers and by product and services for the years ended December 31, 2019, 2018 and 2017 is included in Note 3 to the consolidated financial statements.

Sales to customers in the United States represented $43.4 million or 37%, of total revenues for the year ended December 31, 2019. Sales to customers in the United States represented $48.1 million or 43% of total revenues for the year ended December 31, 2018, and $45.8 million or 45% for the year ended December 31, 2017.

Sales to customers in China represented $15.4 million or 13%, of total revenues for the year ended December 31, 2019. Sales to customers in China represented $14.0 million or 12% for year ended December 31, 2018, and 11% or $11.1 million, of total revenues for 2017. Except for China, no other foreign country or jurisdiction had sales in excess of 10% of our total revenue during the years 2019, 2018 and 2017.

No individual customer represented more than 10% of our total revenues for the fiscal years ended December 31, 2019, 2018, and 2017 respectively. Revenues from our five largest customers were 17% for both the years ended December 31, 2019 and 2018, and 14% for the year ended December 31, 2017.

We had long-lived assets consisting of property, plant and equipment, net of accumulated depreciation, in the following geographic areas for each year presented (in thousands):

	December 31,	
	2019	2018
United States	$ 422	$ 1,881
Singapore	2,489	3,748
Canada	4,942	3,104
EMEA	169	66
Asia-Pacific	34	26
Total	$ 8,056	$ 8,825

14. Commitments and Contingencies

Commitments

In the normal course of business, we enter into various contractual and legally binding purchase commitments. As of December 31, 2019, these commitments were approximately $2.2 million.

In December 2019, we also entered into a Sales and Purchase Agreement with the shareholders of InstruNor AS to purchase all of the outstanding shares of InstruNor AS. The purchase price was approximately $5.2 million in cash and 485,451 shares of our stock. The transaction closed in January 2020.

Indemnifications

From time to time, we have entered into indemnification provisions under certain of our agreements in the ordinary course of business, typically with business partners, customers, and suppliers. Pursuant to these agreements, we may indemnify, hold harmless, and agree to reimburse the indemnified parties on a case-by-case basis for losses suffered or incurred by the indemnified parties in connection with any patent or other intellectual property infringement claim by any third party with respect to our products. The term of these indemnification provisions is generally perpetual from the time of the execution of the agreement. The maximum potential amount of future payments we could be required to make under these indemnification provisions is typically not limited to a specific amount. In addition, we have entered into indemnification agreements with our officers, directors, and certain other employees. With certain exceptions, these agreements provide for indemnification for related expenses including, among others, attorneys' fees, judgments, fines and settlement amounts incurred by any of these individuals in any action or proceeding.

We incurred legal expenses between October 2015 and the third quarter of 2017 to defend claims by Thermo Fisher Scientific, Inc., (Thermo) against one of our employees. In December 2015, Thermo filed a complaint in the Circuit Court for the County of Kalamazoo, Michigan against one of its former employees who had recently been hired by us alleging, among other claims, misappropriation of proprietary information and breach of contractual and fiduciary obligations to Thermo while such individual was still an employee of Thermo. In November 2016, Thermo amended its complaint to add us as a party to the litigation, making various commercial and employment-related claims and seeking damages and injunctive relief. In July 2017, we entered into a settlement agreement with Thermo. Pursuant to the terms of the settlement agreement, we agreed to pay Thermo a one-time payment of $3.0 million in exchange for a release and dismissal of all claims with prejudice upon payment of the settlement. In August 2017, we paid the settlement of $3.0 million and received an insurance recovery payment of $1.0 million related to this matter.

Contingencies

In early March 2019, we experienced a ransomware attack that infiltrated and encrypted certain of our information technology systems, including systems containing critical business data. Immediately following the attack, actions were taken to recover the compromised systems and we believe we were able to restore their operation without significant loss of business data. Based on the nature of the attack and its impact on our systems, we do not believe confidential data was lost or disclosed, but we are continuing to monitor the situation. The costs associated with the intrusion to be approximately $0.1 million, net of insurance proceeds.

From time to time, we may be subject to various legal proceedings and claims arising in the ordinary course of business. These include disputes and lawsuits related to intellectual property, mergers and acquisitions, licensing, contract law, tax, regulatory, distribution arrangements, employee relations and other matters. Periodically, we review the status of each matter and assess its potential financial exposure. If the potential loss from any claim or legal proceeding is considered probable and a range of possible losses can be estimated, we accrue a liability for the estimated loss. Legal proceedings are subject to uncertainties, and the outcomes are difficult to predict. Because of such uncertainties, accruals are based only on the best information available at the time. As additional information becomes available, we continue to reassess the potential liability related to pending claims and litigation and may revise estimates.

15. Quarterly Results of Operations (Unaudited)

Selected quarterly results of operations for the years ended December 31, 2019 and 2018 are as follows (in thousands, except for per share amounts):

2019	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Total revenue	$ 30,111	$ 28,196	$ 26,496	$ 32,440
Net loss	$ (25,465)	$ (13,753)	$ (12,887)	$ (12,685)
Net loss per share, basic and diluted	$ (0.44)	$ (0.20)	$ (0.19)	$ (0.18)

2018	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Total revenue	$ 25,248	$ 26,428	$ 28,963	$ 32,325
Net loss	$ (13,247)	$ (16,241)	$ (14,750)	$ (14,775)
Net loss per share, basic and diluted	$ (0.34)	$ (0.42)	$ (0.38)	$ (0.36)

16. Subsequent Event

On December 17, 2019, we entered into a Sales and Purchase Agreement with the shareholders of InstruNor AS, a privately held Norwegian company (InstruNor), to purchase all of the outstanding shares of InstruNor. The purchase price was approximately $5.2 million in cash and 485,451 shares of our stock. The transaction closed on January 17, 2020 for a total purchase price of $7.2 million.

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

ITEM 9A. CONTROLS AND PROCEDURES

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our Chief Executive Officer and our Chief Financial Officer, evaluated the effectiveness of our disclosure controls and procedures as of December 31, 2019. The term “disclosure controls and procedures,” as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act, means controls and other procedures of a company that are designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the SEC’s rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is accumulated and communicated to the company’s management, including its principal executive and principal financial officers, as appropriate to allow timely decisions regarding required disclosure. Management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Based on the evaluation of our disclosure controls and procedures as of December 31, 2019, our Chief Executive Officer and Chief Financial Officer concluded that, as of such date, our disclosure controls and procedures were effective at the reasonable assurance level.

Management’s Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting (as such term is defined in Exchange Act Rule 13a-15(f) to provide reasonable assurance regarding the reliability of our financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. Management assessed our internal control over financial reporting as of December 31, 2019. Management based its assessment on criteria established in *Internal Control—Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 Framework). Based on that evaluation, our management concluded that our internal control over financial reporting was effective as of December 31, 2019.

The effectiveness of our internal control over financial reporting as of December 31, 2019 has been audited by PricewaterhouseCoopers, LLP, an independent registered public accounting firm, as stated in their report included in this Annual Report on Form 10-K.

Changes in Internal Control Over Financial Reporting

There were no changes in our internal control over financial reporting that occurred during the three months ended December 31, 2019 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Inherent Limitations on the Effectiveness of Controls

Control systems, no matter how well conceived and operated, are designed to provide a reasonable, but not an absolute, level of assurance that the objectives of the control system are met. Further, the design of a control system must reflect the fact that there are resource constraints, and the benefits of controls must be considered relative to their costs. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that all control issues and instances of fraud, if any, have been detected. Because of the inherent limitations in any control system, misstatements due to error or fraud may occur and not be detected.

ITEM 9B. OTHER INFORMATION

On February 26, 2020, Nicholas Khadder notified the Company of his intention to resign from his position as Senior Vice President, General Counsel and Corporate Secretary, and from any and all other positions he holds as an officer or employee of the Company, in order to pursue another opportunity. Mr. Khadder's resignation is effective as of March 13, 2020.

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The information called for by this item will be set forth in our Proxy Statement for the Annual Meeting of Stockholders to be filed with the SEC within 120 days of the fiscal year ended December 31, 2019 and is incorporated herein by reference.

Our board of directors has adopted a Code of Ethics and Conduct that applies to all of our employees, officers and directors, including our Chief Executive Officer, Chief Financial Officer and other executive and senior financial officers. The full text of our code of business conduct and ethics is posted on the investor relations page on our website which is located at www.fluidigm.com. We will post any amendments to our code of business conduct and ethics, or waivers of its requirements, on our website.

ITEM 11. EXECUTIVE COMPENSATION

The information called for by this item will be set forth in our Proxy Statement and is incorporated herein by reference.

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

The information, if any, required by this item will be set forth in our Proxy Statement and is incorporated herein by reference.

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

The information, if any, required by this item will be set forth in our Proxy Statement and is incorporated herein by reference.

ITEM 14. PRINCIPAL ACCOUNTING FEES AND SERVICES

The information required by this item will be set forth in our Proxy Statement and is incorporated herein by reference.

PART IV

ITEM 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES

1. **Financial Statements.** See “Index to Consolidated Financial Statements” in Part II, Item 8 of this Form 10-K.

2. **Financial Statement schedule.** See “Index to Consolidated Financial Statements” in Part II, Item 8 of this Form 10-K.

3. **Exhibits.** The exhibits listed in the accompanying Index to Exhibits are filed herewith or are incorporated by reference to exhibits previously filed with the U.S. Securities and Exchange Commission.

SCHEDULE II—VALUATION AND QUALIFYING ACCOUNTS AND RESERVES

	In thousands			
	Balance at Beginning of Period	Additions/ Charged to Expense	Deductions	Balance at End of Period
Year ended December 31, 2019				
Accounts receivable allowance	$ 126	$ 179	$ (299)	$ 6
Year ended December 31, 2018				
Accounts receivable allowance	$ 391	$ 162	$ (427)	$ 126
Year ended December 31, 2017				
Accounts receivable allowance	$ 502	$ 24	$ (135)	$ 391

	In thousands			
	Balance at Beginning of Period	Additions/ Charged to Expense	Deductions	Balance at End of Period
Year ended December 31, 2019				
Warranty allowance	$ 863	$ 1,386	$ (859)	$ 1,390
Year ended December 31, 2018				
Warranty allowance	$ 699	$ 1,573	$ (1,409)	$ 863
Year ended December 31, 2017				
Warranty allowance	$ 1,023	$ 695	$ (1,019)	$ 699

ITEM 16. FORM 10-K SUMMARY

None.

INDEX TO EXHIBITS

Exhibit Number	Description	Incorporated by Reference From Form	Incorporated by Reference From Exhibit Number	Date Filed
2.1	Agreement and Plan of Merger dated January 28, 2014 by and among Fluidigm Corporation, DVS Sciences, Inc., Dawid Merger Sub, Inc. and Shareholder Representative Services LLC.	8-K	2.1	1/29/2014
3.1	Eighth Amended and Restated Certificate of Incorporation of Fluidigm Corporation filed on February 15, 2011.	10-K	3.1	3/28/2011
3.2	Amended and Restated Bylaws of Fluidigm Corporation effective as of February 9, 2011.	10-K	3.2	3/28/2011
3.3	Certificate of Designation of Rights, Preferences and Privileges of Series A Participating Preferred Stock.	8-K	3.1	11/22/2016
3.4	Certificate of Elimination of Series A Participating Preferred Stock of Fluidigm Corporation.	8-K	3.1	8/2/2017
4.1	Specimen Common Stock Certificate of Fluidigm Corporation.	S-8	4.1	8/3/2017
4.2	Indenture, dated February 4, 2014, by and between Fluidigm Corporation and U.S. Bank National Association.	8-K	4.1	2/4/2014
4.3	First Supplemental Indenture, dated February 4, 2014, by and between Fluidigm Corporation and U.S. Bank National Association.	8-K	4.2	2/4/2014
4.4	Form of Global Note (included in Exhibit 4.3).	8-K	4.3	2/4/2014
4.5	Description of Securities.	Filed herewith		
4.6	Indenture, dated November 22, 2019, by and between Fluidigm Corporation and U.S. Bank National Association.	8-K	4.1	11/22/2019
4.7	Form of 5.25% Convertible Senior Note due 2024 (included in Exhibit 4.7).	8-K	4.2	11/22/2019
10.1	Form of Indemnification Agreement between Fluidigm Corporation and its directors and officers.	S-1/A	10.1	1/28/2011
10.2	Lease between AP3-SF3 CT North, LLC and Fluidigm Corporation, dated March 20, 2019.	10-Q	10.1	5/7/2019
10.2A	First Amendment to Lease between AP3-SF3 CT North, LLC and Fluidigm Corporation, dated April 26, 2019.	10-Q	10.2	5/7/2019
10.3#	2009 Equity Incentive Plan of Fluidigm Corporation, as amended.	S-1	10.3	12/3/2010
10.3A#	Forms of agreements under the 2009 Equity Incentive Plan.	S-1	10.3A	12/3/2010
10.4#	Fluidigm Corporation 2011 Equity Incentive Plan, as amended and restated effective June 3, 2019.	8-K	10.1	6/5/2019
10.4A#	Forms of agreements under the 2011 Equity Incentive Plan.	S-1/A	10.4A	1/28/2011
10.4B#	Amendments to the Fluidigm Corporation 2011 Equity Incentive Plan and 2009 Equity Incentive Plan and the DVS Sciences, Inc. 2010 Equity Incentive Plan.	8-K	10.2	8/2/2017
10.4C#	Forms of U.S. agreements under the 2011 Equity Incentive Plan.	SC TO-I	(d)(2)	8/23/2017

Exhibit Number	Description	Incorporated by Reference From Form	Incorporated by Reference From Exhibit Number	Date Filed
10.4D	Rules of the Fluidigm Corporation 2011 Equity Incentive Plan for Restricted Stock Unit Awards Granted to French Participants.	SC TO-I	(d)(3)	8/23/2017
10.4E	Rules of the Fluidigm Corporation 2011 Equity Incentive Plan for Options Granted to French Participants.	SC TO-I	(d)(4)	8/23/2017
10.4F	UK Sub-plan to the Fluidigm Corporation 2011 Equity Incentive Plan.	SC TO-I	(d)(5)	8/23/2017
10.4G#	Form of Restricted Stock Unit Agreement-Non-U.S. under the 2011 Equity Incentive Plan.	SC TO-I	(d)(6)	8/23/2017
10.4H#	Form of Stock Option Agreement-Non-U.S. under the 2011 Equity Incentive Plan.	SC TO-I	(d)(7)	8/23/2017
10.5#	Fluidigm Corporation 2017 Inducement Award Plan and related form agreements.	8-K	10.1	1/11/2017
10.6#	2017 Employee Stock Purchase Plan.	8-K	10.1	8/2/2017
10.7#	Executive Bonus Plan.	10-K	10.25	3/28/2011
10.8†	Second Amended and Restated License Agreement between California Institute of Technology and Fluidigm Corporation, effective as of May 1, 2004.	S-1	10.5	12/3/2010
10.8A†	First Addendum, effective as of March 29, 2007, to Second Amended and Restated License Agreement between California Institute of Technology and Fluidigm Corporation effective as of May 1, 2004.	S-1	10.5A	12/3/2010
10.9†	Co-Exclusive License Agreement between President and Fellows of Harvard College and Fluidigm Corporation effective as of October 15, 2000.	S-1	10.6	12/3/2010
10.9A†	First Amendment to Co-Exclusive License Agreement between President and Fellows of Harvard College and Fluidigm Corporation effective as of October 15, 2000.	S-1	10.6A	12/3/2010
10.10†	Co-Exclusive License Agreement between President and Fellows of Harvard College and Fluidigm Corporation effective as of October 15, 2000.	S-1	10.7	12/3/2010
10.11†	Co-Exclusive License Agreement between President and Fellows of Harvard College and Fluidigm Corporation effective as of October 15, 2000.	S-1	10.8	12/3/2010
10.12†	Letter Agreement between President and Fellows of Harvard College and Fluidigm Corporation dated December 22, 2004.	S-1	10.9	12/3/2010
10.13	Loan and Security Agreement, dated as of August 2, 2018 by and between Fluidigm Corporation and Silicon Valley Bank.	8-K	10.1	8/2/2018
10.13A	Default Waiver and First Amendment to Loan and Security Agreement, dated September 1, 2018, between the Company and Silicon Valley Bank.	Filed herewith		
10.13B	Second Amendment to Loan and Security Agreement, dated November 20, 2019, between the Company and Silicon Valley Bank.	8-K	10.2	11/22/2019
10.14	Purchase Agreement, dated November 20, 2019, between Fluidigm Corporation and Barclays Capital Inc., as representative of the several initial purchasers named in Schedule I thereto.	8-K	10.1	11/22/2019
10.15#	Form of Amended and Restated Employment and Severance Agreement between Fluidigm Corporation and each of its executive officers.	8-K	10.14	12/11/2012

Exhibit Number	Description	Incorporated by Reference From Form	Incorporated by Reference From Exhibit Number	Date Filed
10.16#	Fluidigm Corporation Change of Control and Severance Plan.	8-K	10.1	8/23/2017
10.17#	Endorsement Split-Dollar Life Insurance Agreement.	10-Q	10.5	11/7/2017
10.18#	Offer Letter to Stephen Christopher Linthwaite, dated July 14, 2016.	10-Q	10.1	5/8/2018
10.19#	Employment and Severance Agreement, effective as of August 1, 2016, by and between Fluidigm Corporation and Stephen Christopher Linthwaite.	10-Q	10.2	11/9/2016
10.20#	Offer Letter to Vikram Jog dated January 29, 2008.	S-1	10.17	12/3/2010
10.21#	Offer Letter to Bradley A. Kreger dated February 13, 2018.	10-K	10.18	3/18/2019
10.22	Lease Agreement between ARE - San Francisco No. 17 LLC and Fluidigm Corporation, dated September 14, 2010, as amended September 22, 2010.	S-1/A	10.19	1/7/2011
10.22A	Second Amendment to Lease Agreement between ARE-San Francisco No. 17, LLC and Fluidigm Corporation, dated April 9, 2013.	10-Q	10.19A	5/9/2013
10.22B	Fourth Amendment to Lease Agreement between ARE-San Francisco No. 17, LLC and Fluidigm Corporation, dated June 4, 2014.	10-Q	10.3	8/4/2014
10.22C	Fifth Amendment to Lease Agreement between ARE-San Francisco No. 17, LLC and Fluidigm Corporation, dated September 15, 2014.	10-Q	10.2	11/6/2014
10.22D	Sixth Amendment to Lease Agreement between ARE-San Francisco No. 17, LLC and Fluidigm Corporation, dated December 8, 2015.	8-K	10.1	12/14/2015
10.22E	Seventh Amendment to Lease Agreement between ARE-San Francisco No. 17, LLC and Fluidigm Corporation, dated March 23,2017.	10-Q	10.1	5/9/2017
10.22F	Eighth Amendment to Lease Agreement between ARE-San Francisco No. 17, LLC and Fluidigm Corporation, dated August 2, 2017.	8-K	10.1	8/3/2017
10.22G	Ninth Amendment to Lease Agreement between ARE-San Francisco No. 17, LLC and Fluidigm Corporation, dated May 31, 2018.	10-Q	10.2	8/8/2018
10.22H	Tenth Amendment to Lease Agreement between ARE-San Francisco No. 17, LLC and Fluidigm Corporation, dated August 14, 2019.	10-Q	10.1	11/8/2019
10.23	Tenancy for Flatted Factory Space in Singapore between JTC Corporation and Fluidigm Corporation dated July 27, 2005, as amended August 12, 2008 and May 31, 2010.	S-1	10.20	12/3/2010
10.24	Offer of Tenancy for Facility Lease between Fluidigm Singapore Pte. Ltd. and SBC Institutional Trust Services (Singapore) Limited, as trustee of Ascendas Real Estate Investment Trust dated October 14, 2013.	10-K	10.21	3/12/2014
10.25	Offer of Tenancy for Lease of Additional Space at Singapore Facility between Fluidigm Singapore Pte. Ltd. and HSBC Institutional Trust Services (Singapore) Limited, as trustee of Ascendas Real Estate Investment Trust, dated April 2, 2015.	10-Q	10.1	8/10/2015
10.26†	Office Lease by and among Rodick Equities Inc., Fluidigm Canada Inc., and Fluidigm Corporation, dated August 17, 2015.	10-Q	10.1	11/9/2015

Exhibit Number	Description	Incorporated by Reference From Form	Incorporated by Reference From Exhibit Number	Date Filed
10.27†	License Agreement between MDS Analytical Technologies, a business unit of MDS INC., and DVS Sciences Inc., dated July 17, 2008.	10-Q/A	10.3	9/15/2014
10.28†	Sublicense Agreement between DVS Sciences Inc. and Fluidigm Corporation, dated January 28, 2014.	10-Q/A	10.4	9/15/2014
21.1	Subsidiaries of Fluidigm Corporation.	10-K	21.1	3/3/2017
23.1	Consent of PricewaterhouseCoopers LLP, Independent Registered Public Accounting Firm.	Filed herewith		
24.1	Power of Attorney (contained in the signature page to this Form 10-K).	Filed herewith		
31.1	Certification Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002 of Chief Executive Officer.	Filed herewith		
31.2	Certification Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002 of Chief Financial Officer.	Filed herewith		
32.1~	Certification Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 of Chief Executive Officer.	Filed herewith		
32.2~	Certification Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 of Chief Executive Officer.	Filed herewith		
101.INS	XBRL Instance Document - the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document.	Filed herewith		
101.SCH	XBRL Taxonomy Extension Schema Document	Filed herewith		
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document	Filed herewith		
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document	Filed herewith		
101.LAB	XBRL Taxonomy Extension Label Document	Filed herewith		
101.PRE	XBRL Taxonomy Extension Presentation Document	Filed herewith		

\# Management contracts or compensation plans or arrangements in which directors or executive officers are eligible to participate.

† Portions of the exhibit have been omitted pursuant to an order granted by the Securities and Exchange Commission for confidential treatment.

~ In accordance with Item 601(b)(32)(ii) of Regulation S-K and SEC Release No. 33-8238 and 34-47986, Final Rule: Management's Reports on Internal Control Over Financial Reporting and Certification of Disclosure in Exchange Act Periodic Reports, the certifications furnished in Exhibits 32.1 and 32.2 hereto are deemed to accompany this Form 10-K and will not be deemed "filed" for purposes of Section 18 of the Exchange Act. Such certifications will not be deemed to be incorporated by reference into any filings under the Securities Act or the Exchange Act, except to the extent that Fluidigm Corporation specifically incorporates it by reference.

SIGNATURES

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

FLUIDIGM CORPORATION

Dated: February 27, 2020

By: /s/ Stephen Christopher Linthwaite

Stephen Christopher Linthwaite

President and Chief Executive Officer

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints Stephen Christopher Linthwaite and Vikram Jog, jointly and severally, as his or her true and lawful attorneys-in-fact and agents, with full power of substitution and resubstitution, for him or her and in his or her name, place and stead, in any and all capacities, to sign this Form 10-K, and to file the same, with all exhibits thereto, and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents full power and authority to do and perform each and every act and thing requisite or necessary to be done in and about the premises hereby ratifying and confirming all that said attorneys-in-fact and agents, or his or their substitute or substitutes, may lawfully do or cause to be done by virtue hereof.

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

Signature	Title	Date
/s/ Stephen Christopher Linthwaite **Stephen Christopher Linthwaite**	President and Chief Executive Officer (Principal Executive Officer); Director	February 27, 2020
/s/ Vikram Jog **Vikram Jog**	Chief Financial Officer (Principal Financial and Accounting Officer)	February 27, 2020
/s/ Samuel D. Colella **Samuel D. Colella**	Chairman of the Board of Directors	February 27, 2020
/s/ Nicolas M. Barthelemy **Nicolas M. Barthelemy**	Director	February 27, 2020
/s/ Gerhard F. Burbach **Gerhard F. Burbach**	Director	February 27, 2020
/s/ Laura M. Clague **Laura M. Clague**	Director	February 27, 2020
/s/ Bill W. Colston **Bill W. Colston**	Director	February 27, 2020
/s/ Patrick S. Jones **Patrick S. Jones**	Director	February 27, 2020
/s/ Carlos V. Paya **Carlos V. Paya**	Director	February 27, 2020

2 Tower Place, Suite 2000
South San Francisco, California 94080
(650) 266-6000

May 14, 2020

Dear Stockholder:

You are cordially invited to attend the Annual Meeting of Stockholders of Fluidigm Corporation to be held on Tuesday, June 23, 2020 at 8:30 a.m., Pacific time, at our principal executive offices located at 2 Tower Place, Suite 2000, South San Francisco, California 94080. At the meeting, we will be voting on the matters described in the attached formal meeting notice and proxy statement.

This year, we are again taking advantage of U.S. Securities and Exchange Commission rules that allow companies to furnish proxy materials to their stockholders over the Internet. We believe that this process will allow us to provide our stockholders with the information they need in a timely manner, while reducing the environmental impact of printing and distributing our proxy materials and lowering our costs.

On or about May 14, 2020, we expect to mail to our stockholders a Notice of Internet Availability of Proxy Materials (the "Notice") containing instructions on how to access the proxy statement for our 2020 Annual Meeting and our Annual Report on Form 10-K for the year ended December 31, 2019. The Notice also provides instructions for voting online or by telephone, as well as information on how to receive a paper copy of the proxy materials by mail.

Your vote is very important. Whether or not you plan to attend the Annual Meeting and regardless of the number of shares you own, it is important that your shares be represented. We hope you will vote as soon as possible via the Internet, by telephone, or—if you requested a paper copy of the proxy materials by mail—by mailing a completed, signed, and dated proxy card in the envelope provided. Any stockholder who attends the meeting may vote in person, even if he or she has already voted online, by telephone, or by mail.

Because of the uncertainties surrounding the impact of the SARS-CoV-2 pandemic (frequently referred to as COVID-19), we are planning for the possibility that the Annual Meeting may be held solely by means of remote communication. If we take this step, we will announce the decision to do so in advance of the Annual Meeting, and details on how to participate in the webcast will be set forth in a press release issued by the Company and available at investors.fluidigm.com. If you are planning to attend the Annual Meeting in person, we recommend you check with the SEC and/or our website one week in advance of June 23, 2020.

As a final note and also on behalf of the Board of Directors, I would like to thank Pat Jones and Sam Colella, our directors who are retiring from our Board in June, for their counsel and guidance.

Thank you for your continued support of Fluidigm. We look forward to seeing you at our Annual Meeting.

Sincerely,

Stephen Christopher Linthwaite
President and Chief Executive Officer

FLUIDIGM CORPORATION
2 Tower Place, Suite 2000
South San Francisco, California 94080
(650) 266-6000

NOTICE OF 2020 ANNUAL MEETING OF STOCKHOLDERS

Time and Date	8:30 a.m., Pacific time, on Tuesday, June 23, 2020.
Place	Fluidigm's offices located at 2 Tower Place, Suite 2000, South San Francisco, California 94080.
Contingent Virtual Meeting	Due to the ongoing and evolving public health impact of the 2019 novel coronavirus (SARS-CoV-2) pandemic (referred to as "COVID-19"), we will continue to monitor the appropriateness of conducting the Annual Meeting in person. As a result, we may impose additional procedures or limitations on attendees beyond any described in this Notice of Annual Meeting of Stockholders and the accompanying materials in our Definitive Proxy Statement. Alternatively, our Board of Directors may opt to change the Annual Meeting to one conducted by means of remote communication (i.e., a virtual meeting). In the event we decide to hold our Annual Meeting remotely, we will announce the decision to do so in advance, and details on how to participate will be set forth via a press release that will be filed with the SEC and which we will make available on our website at investors.fluidigm.com . If you are planning to attend the Annual Meeting in person, we recommend that you check with the SEC and/ or our website one week in advance of June 23, 2020. If your Notice, your proxy card or other voting instructions accompanying your proxy materials include a 16-digit or similar control number, please retain that number as you may need it to participate in the Annual Meeting if we conduct it remotely.
Items of Business	• To elect the two nominees for Class I director named in this proxy statement, each to hold office until our 2023 annual meeting of stockholders or until his successor is duly elected and qualified. • To vote, on an advisory basis, to approve the compensation of our named executive officers for the year ended December 31, 2019, as set forth in this proxy statement. • To vote on an amendment and restatement of our 2017 Employee Stock Purchase Plan to increase the shares reserved thereunder and to make certain other changes. • To vote on an amendment to our 2011 Equity Incentive Plan to increase the shares reserved thereunder. • To ratify the appointment of PricewaterhouseCoopers LLP as our independent registered public accounting firm for the year ending December 31, 2020. • To transact any other business that may properly come before the 2020 Annual Meeting.
Adjournments and Postponements	Any action on the items of business described above may be considered at the Annual Meeting at the time and on the date specified above or at any time and date to which the Annual Meeting may be properly adjourned or postponed.

Record Date	You are entitled to vote only if you were a Fluidigm stockholder of record as of the close of business on the record date, May 1, 2020.
Meeting Admission	**You are entitled to attend the Annual Meeting only if you were a Fluidigm stockholder as of the close of business on the record date or otherwise hold a valid proxy for the Annual Meeting.** If you are not a stockholder of record but hold shares through a broker, bank, trustee, or nominee (i.e., in "street name"), you should provide proof of your beneficial ownership as of the record date, such as your most recent account statement prior to the record date, a copy of the voting instruction card provided by your broker, bank, trustee, or nominee, or similar evidence of ownership.
Annual Report	You may access our Annual Report on Form 10-K for the year ended December 31, 2019 and our proxy solicitation materials by visiting www.ProxyVote.com. Our 2019 Annual Report is not a part of the proxy solicitation materials.
Voting	Your vote is very important. Whether or not you plan to attend the Annual Meeting, we encourage you to read the proxy statement accompanying this notice and submit your proxy or voting instructions as soon as possible. For specific instructions on how to vote your shares, please refer to the instructions in the section entitled "General Information" beginning on page 1 of the proxy statement accompanying this notice, or provided in the Notice of Internet Availability of Proxy Materials.

This notice of our Annual Meeting of Stockholders and the accompanying proxy statement and form of proxy are being distributed and made available on or about May 14, 2020.

PROXY STATEMENT
FOR 2020 ANNUAL MEETING OF STOCKHOLDERS

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FLUIDIGM CORPORATION
2 Tower Place, Suite 2000
South San Francisco, California 94080

PROXY STATEMENT

FOR THE 2020 ANNUAL MEETING OF STOCKHOLDERS
to be held on Tuesday, June 23, 2020

GENERAL INFORMATION

In this proxy statement: the terms “we,” “our,” “Fluidigm,” and the “Company” each refer to Fluidigm Corporation; the term “Board” means our Board of Directors; and the term “proxy materials” means this proxy statement and the form of proxy. These proxy materials are furnished in connection with the solicitation by our Board of proxies to be voted at our 2020 annual meeting of stockholders, which will take place on Tuesday, June 23, 2020 at 8:30 a.m., Pacific time at the Company’s offices located at 2 Tower Place, Suite 2000, South San Francisco, California 94080, and any postponements, adjournments or continuations thereof (the “Annual Meeting”).

The information provided in the “question and answer” format below is for your convenience only and is merely a summary of the information contained in this proxy statement. You should read this entire proxy statement carefully. Information contained on or accessible through our website is not intended to be incorporated by reference into this proxy statement and references to our website in this proxy statement are intended to be inactive textual references only.

1. Why did I receive a notice regarding the availability of proxy materials on the Internet instead of a full set of proxy materials?

Under rules adopted by the U.S. Securities and Exchange Commission (the “SEC”), we have elected to furnish our proxy materials to our stockholders primarily via the Internet, instead of mailing printed copies of the proxy materials to each stockholder. On or about May 14, 2020, we expect to mail to our stockholders a Notice of Internet Availability of Proxy Materials (the “Notice”) containing instructions on how to access our proxy materials and our Annual Report on Form 10-K for the year ended December 31, 2019 via the Internet and how to vote your proxy. If you received the Notice, you will not automatically receive a printed copy of our proxy materials in the mail. If you would like to receive a printed copy, please follow the instructions provided in the Notice.

Our 2020 proxy materials and our 2019 Annual Report are accessible at: www.ProxyVote.com

2. What if existing or revised COVID-19 restrictions are in effect or the Annual Meeting is held by remote communication?

Due to the ongoing and evolving public health impact of the COVID-19 pandemic, we are monitoring the need to impose additional procedures or limitations on attendees to protect the health and safety of our employees, directors and stockholders. Should our Board determine that any procedural or other limitations we may implement to protect the health and safety of our employees, directors or stockholders who choose to attend our Annual Meeting in person may not be effective or that to conduct the Annual Meeting in person would violate or impede any recommendations, laws or orders of public officials, we may decide to conduct the Annual Meeting solely by means of remote communication (i.e., a virtual-only meeting over live webcast). In the event we decide to modify the structure of our Annual Meeting, we will announce the decision to do so in advance, and details on how to participate will be set forth via a press release that will be filed with the SEC and available on our website at investors.fluidigm.com. If you are planning to attend the Annual Meeting in person, we recommend you check with the SEC and/or our website one week in advance of June 23, 2020.

Accordingly, considering all the uncertainties surrounding the COVID-19 public health crisis, we strongly recommend that you promptly cast your vote via the Internet, telephone or, if you received paper copies of the proxy materials, by mail, to ensure your representation at the Annual Meeting and that your vote is counted.

If your Notice of the Annual Meeting, your proxy card or other voting instructions accompanying your proxy materials include a 16-digit or similar control number, please retain that number as you may need it to participate in the Annual Meeting if we conduct it remotely.

3. What information is contained in this proxy statement?

The information in this proxy statement relates to the proposals to be voted on at the Annual Meeting, the voting process, the compensation of our directors and most highly paid executive officers, our corporate governance policies, information on our Board, and certain other required information.

4. What items of business will be voted on at the Annual Meeting?

The items of business scheduled to be voted on at the Annual Meeting are as follows:

- the election of the two nominees for Class I director named in this proxy statement, each to hold office until our 2023 annual meeting of stockholders or until his successor is duly elected and qualified;
- to vote, on an advisory basis, to approve the compensation of our named executive officers for the year ended December 31, 2019, as set forth in this proxy statement;
- to vote on an amendment and restatement of our 2017 Employee Stock Purchase Plan (“ESPP”) to increase the shares reserved thereunder and to make certain other changes;
- to vote on an amendment to our 2011 Equity Incentive Plan (“2011 Plan”) to increase the number of shares reserved thereunder; and
- to ratify the appointment of PricewaterhouseCoopers LLP as our independent registered public accounting firm for the year ending December 31, 2020.

We will also transact any other business that properly comes before the Annual Meeting.

5. How does the Board recommend that I vote?

Our Board recommends that you vote your shares:

- “FOR” the nominees for Class I director named in this proxy statement;
- “FOR” approval of the compensation of our named executive officers for the year ended December 31, 2019, on an advisory basis;
- “FOR” approval of the amendment and restatement of our ESPP to increase the shares reserved thereunder and to make certain other changes;
- “FOR” approval of the amendment of our 2011 Plan to increase the shares reserved thereunder ; and
- “FOR” the ratification of the appointment of PricewaterhouseCoopers LLP as our independent registered public accounting firm for the year ending December 31, 2020.

6. What is a proxy?

A proxy is your legal designation of another person to vote the stock you own, in the event that you are unable to cast your vote directly at the meeting. The person you designate is your “proxy,” and you give the proxy authority to vote your shares at the meeting—according to your instructions—by submitting your voting instructions online, by telephone, or via a physical proxy card. We have designated our President and Chief Executive Officer (“CEO”), Stephen Christopher Linthwaite, and our Chief Financial Officer, Vikram Jog, to serve as proxies for the Annual Meeting.

7. What shares can I vote?

Each share of our common stock issued and outstanding as of the close of business on May 1, 2020, the record date for our 2020 Annual Meeting, is entitled to vote on all items being considered at the Annual Meeting. You may vote all shares owned by you as of the record date, including (i) shares held directly in your name as the stockholder of record and (ii) shares you own through an account with a broker, bank, trustee, or other intermediary, sometimes referred to as owning in “street name.” On the record date, we had 70,706,062 shares of common stock issued and outstanding.

8. How many votes am I entitled to per share?

For all matters described in this proxy statement for which your vote is being solicited, each holder of shares of common stock is entitled to one vote for each share of common stock held by such holder as of the record date.

9. What is the difference between holding shares as a stockholder of record and as a beneficial owner?

Many stockholders beneficially own shares held in “street name” by a broker, bank, trustee, or other nominee rather than holding the shares directly in their own name. As summarized below, there are some distinctions between shares held of record and those owned beneficially.

- ***Stockholder of Record.*** If your shares are registered directly in your name with our transfer agent, Computershare Trust Company, N.A., you are considered the stockholder of record with respect to those shares, and the Notice was sent directly to you by our mailing agent. As the stockholder of record, you have the right to grant your voting proxy directly to our designated proxies or to vote in person at the Annual Meeting. You may vote online or by telephone as described below under the heading "How can I vote my shares without attending the annual meeting?" and on the Notice. If you requested a printed copy of the proxy materials, you may also vote by mail by following the instructions on your proxy card.

- ***Beneficial Owner.*** If your shares are held in a brokerage account or by another intermediary, you are considered the beneficial owner of shares held in street name, and the Notice was forwarded to you by your broker, bank, trustee, or other nominee. As the beneficial owner, you have the right to direct your broker, bank, trustee, or other nominee how to vote your shares, and you are also invited to attend the Annual Meeting.

  Since a beneficial owner is not the stockholder of record, you may not vote your shares in person at the Annual Meeting unless you obtain a "legal proxy" from the broker, bank, trustee or nominee that holds your shares giving you the right to vote the shares at the meeting. If you are a beneficial owner and do not wish to vote in person or you will not be attending the Annual Meeting, you may vote by following the instructions provided by your broker, bank, trustee, or other nominee.

10. How can I contact Fluidigm's transfer agent?

Contact our transfer agent by writing Computershare Trust Company, N.A., 462 South 4th Street, Suite 1600, Louisville, KY 40202. You may also contact our transfer agent by calling (800) 662-7232 or (781) 575-2879 or via its Investor Center at https://www-us.computershare.com/Investor/Contact.

11. How can I attend the Annual Meeting?

You are entitled to attend the Annual Meeting only if you were a Fluidigm stockholder as of the record date or you hold a valid proxy for the Annual Meeting. If you are not a stockholder of record but beneficially own shares held in street name, you should provide proof of beneficial ownership as of the record date, such as your most recent account statement prior to May 1, 2020, together with a copy of the voting instruction card provided by your broker, bank, trustee or nominee, or other similar evidence of ownership.

If you do not comply with the procedures outlined above, you may not be admitted to the Annual Meeting.

Please let us know if you plan to attend the meeting by indicating your plans when prompted if you vote online or by telephone, or by marking the appropriate box on your proxy card if you vote by mail.

12. Will the Annual Meeting be webcast?

We do not expect to webcast the Annual Meeting unless our Board determines a webcast to be necessary in light of the COVID-19 pandemic. Please see the answer to question 2 above for additional information.

13. How can I vote my shares in person at the Annual Meeting?

Shares held in your name as the stockholder of record may be voted by you in person at the Annual Meeting. Shares owned beneficially and held in street name may be voted by you in person at the Annual Meeting only if you obtain a legal proxy from the broker, bank, trustee, or other nominee that holds your shares giving you the right to vote the shares. Even if you plan to attend the Annual Meeting, we recommend that you also submit your proxy or voting instructions as described below so that your vote will be counted if you later decide not to attend the meeting.

14. How can I vote my shares without attending the Annual Meeting?

By telephone or via the Internet

If you are a stockholder of record, you may vote by following the telephone or Internet voting instructions on your Notice.

If you are a beneficial owner of shares, your broker, bank, trustee, or other nominee may make telephone or Internet voting available to you. The availability of telephone and Internet voting for beneficial owners will depend on the voting processes of your broker, bank, trustee, or other nominee. Therefore, we recommend that you follow the voting instructions in the materials you receive.

By mail, if you requested a printed copy of the proxy materials

If you are a stockholder of record, complete, sign and date the enclosed proxy card or voting instruction card and return it in the return envelope provided (which is postage prepaid if mailed in the United States). If the prepaid envelope is missing, please mail your completed proxy card to Vote Processing, c/o Broadridge Financial Solutions, Inc., 51 Mercedes Way, Edgewood, NY 11717.

If you are a stockholder of record and you return your signed proxy card but do not indicate your voting preferences, the persons named in the proxy card as proxy holders—Stephen Christopher Linthwaite and Vikram Jog—will vote the shares represented by your proxy card as recommended by our Board.

If you are a beneficial owner of shares and you requested a printed copy of the proxy materials from your broker, bank, trustee, or other nominee, simply complete the proxy card and mail it according to the instructions provided by your broker, bank, trustee, or other nominee.

You may attend the Annual Meeting in person even if you have already voted by proxy.

15. Can I change my vote or revoke my proxy?

You may change your vote at any time prior to the taking of the vote at the Annual Meeting. If you are the stockholder of record, you may change your vote by (i) granting a new proxy bearing a later date (which automatically revokes the earlier proxy) using any of the methods described above (and until the applicable deadline for each method), (ii) providing a written notice of revocation to our corporate secretary at Fluidigm Corporation, 2 Tower Place, Suite 2000, South San Francisco, California 94080, Attn: Corporate Secretary, prior to your shares being voted, or (iii) attending the Annual Meeting and voting in person. Attendance at the meeting will not cause your previously granted proxy to be revoked unless you specifically so request. For shares held in street name, you may change your vote by submitting new voting instructions to your broker, bank, trustee, or nominee following the instructions they provided or, if you have obtained a legal proxy from your broker, bank, trustee, or nominee giving you the right to vote your shares, by attending the Annual Meeting and voting in person.

16. Is there a list of stockholders entitled to vote at the Annual Meeting?

The names of stockholders of record entitled to vote at the Annual Meeting will be available at the Annual Meeting and from our corporate secretary for ten days prior to the meeting for any purpose germane to the meeting, between the hours of 9:00 a.m. and 4:30 p.m., at our corporate headquarters at 2 Tower Place, Suite 2000, South San Francisco, California 94080.

17. Is my vote confidential?

Proxy instructions, ballots, and voting tabulations that identify individual stockholders are handled in a manner that protects your voting privacy. Your vote will not be disclosed either within Fluidigm or to third parties, except as necessary to meet applicable legal requirements, to allow for the tabulation of votes and certification of the vote, or to facilitate a successful proxy solicitation.

18. How many shares must be present or represented to conduct business at the Annual Meeting?

Holders of a majority of the issued and outstanding shares of common stock as of the record date must be present in person or represented by proxy, also referred to as a quorum, to hold and transact business at the Annual Meeting. Abstentions and “broker non-votes” are counted as present and entitled to vote for purposes of determining a quorum. A “broker non-vote” occurs when a broker, bank, trustee, or other nominee holding shares for a beneficial owner does not vote on a particular proposal because that holder does not have discretionary voting power for that particular item and has not received voting instructions from the beneficial owner. If there is no quorum, the chairperson of the meeting or the holders of a majority of the issued and outstanding shares of common stock present at the Annual Meeting may adjourn the meeting to another date.

19. What is the voting requirement to approve each of the proposals?

Proposal	Vote Required	Discretionary Voting Allowed?
Election of Class I Directors	Plurality of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the election of directors	No
Advisory Vote on Approval of Executive Compensation	Majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the subject matter	No
Approval of the Amended and Restated 2017 Employee Stock Purchase Plan	Majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the subject matter	No
Approval of the Amended 2011 Equity Incentive Plan	Majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the subject matter	No
Ratification of Appointment of PricewaterhouseCoopers LLP for the year ending December 31, 2020	Majority of the shares of our common stock present in person or represented by proxy at the meeting and entitled to vote on the subject matter	Yes

If you are a beneficial owner, your broker, bank, trustee, or other nominee is permitted to vote your shares on the ratification of the appointment of PricewaterhouseCoopers LLP as our independent registered public accounting firm for the year ending December 31, 2020, even if the record holder does not receive voting instructions from you. However, your broker, bank, trustee, or other nominee does not have discretionary authority to vote on the election of the Class I directors without instructions from you, in which case a broker non-vote will occur and your shares will not be voted on this matter. In addition, discretionary voting is not allowed with respect to the advisory vote to approve the compensation of our named executive officers, the proposal seeking the approval of our amended and restated ESPP, or the proposal seeking the approval of our amended 2011 Plan. Accordingly, if you are a beneficial owner, it is particularly important that you provide your instructions for voting your shares on the election of the Class I directors, the advisory vote on approval of executive compensation, the approval of our amended and restated ESPP and the approval of our amended 2011 Plan to your broker, bank, trustee, or other nominee.

Election of Class I Directors

The election of directors requires a plurality vote of the shares of our common stock present in person or by proxy at the meeting and entitled to vote thereon to be approved. Therefore, the two nominees receiving the highest number of affirmative "FOR" votes will be elected as Class I directors. You may (i) vote "FOR" all nominees, (ii) "WITHHOLD" your vote as to all nominees, or (iii) vote "FOR ALL EXCEPT" for those specific nominees from whom you withhold your vote. A properly executed proxy card marked "WITHHOLD" or "FOR ALL EXCEPT" will not be voted with respect to the election of the applicable Class I director(s) although it will be counted for purposes of determining whether there is a quorum. Abstentions and broker non-votes will not affect the outcome of the election of the Class I directors.

Advisory Vote on Approval of Executive Compensation

The affirmative "FOR" vote of a majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the proposal is required to approve, on an advisory basis, the compensation awarded to our named executive officers for the year ended December 31, 2019. You may vote "FOR," "AGAINST," or "ABSTAIN" on this proposal. Abstentions have the same effect as a vote against the proposal. Broker non-votes are not included in the tabulation of voting results on this proposal, and will not affect the outcome of voting on this proposal. Although the vote is non-binding, our Board and our Compensation Committee value the opinions of our stockholders in this matter and, to the extent there is any significant vote against the named executive officer compensation as disclosed in this proxy statement, we will endeavor to communicate with stockholders to better understand the concerns that influenced the vote, consider our stockholders' concerns and the Compensation Committee will evaluate whether any actions are necessary to address those concerns.

Approval of Amended and Restated 2017 Employee Stock Purchase Plan

The affirmative "FOR" vote of a majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote thereon is required to approve our ESPP. You may vote "FOR," "AGAINST," or "ABSTAIN" on this proposal. Abstentions have the same effect as a vote against the proposal. Broker non-votes are not deemed to be votes cast, are not included in the tabulation of voting results on this proposal, and will not affect the outcome of voting on this proposal.

Approval of Amended 2011 Equity Incentive Plan

The affirmative "FOR" vote of a majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote thereon is required to approve an amendment to our 2011 Plan. You may vote "FOR," "AGAINST," or "ABSTAIN" on this proposal. Abstentions have the same effect as a vote against the proposal. Broker non-votes are not deemed to be votes cast, are not included in the tabulation of voting results on this proposal, and will not affect the outcome of voting on this proposal.

Ratification of Appointment of PricewaterhouseCoopers LLP

The affirmative "FOR" vote of a majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the proposal is required to ratify the appointment of PricewaterhouseCoopers LLP as our independent registered public accounting firm for the year ending December 31, 2020. You may vote "FOR," "AGAINST," or "ABSTAIN" on this proposal. Abstentions have the same effect as a vote against the proposal. Broker non-votes are not included in the tabulation of voting results on this proposal, and will not affect the outcome of voting on this proposal. Notwithstanding the appointment of PricewaterhouseCoopers LLP and even if our stockholders ratify the appointment, our Audit Committee, in its discretion, may appoint another independent registered public accounting firm at any time during our fiscal year if our Audit Committee believes that such a change would be in the best interests of our Company and our stockholders.

20. Interest of Executive Officers and Directors

None of our executive officers or directors has any substantial interest in any matter to be acted upon, other than (i) our directors, with respect to the election to office of the directors so nominated; (ii) our executive officers with respect to the ESPP, in which such executive officers are eligible to participate; and (iii) our directors and executive officers with respect to the amendment to our 2011 Plan, in which such directors and executive officers are eligible to participate.

21. What happens if additional matters are presented at the Annual Meeting?

Other than the items of business described in this proxy statement, we are not aware of any other business to be acted upon at the Annual Meeting. If you grant a proxy, the persons named as proxy holders, Stephen Christopher Linthwaite and Vikram Jog, or either of them, will have the discretion to vote your shares on any additional matters properly presented for a vote at the meeting. If for any reason a Class I director nominee is not available as a candidate for director, the persons named as proxy holders will vote your proxy for such other candidate as may be nominated by our Board.

22. Who will count the votes?

A representative of our mailing agent, Broadridge Financial Solutions, Inc. ("Broadridge"), will tabulate the votes and act as inspector of elections.

23. Who will bear the cost of soliciting votes for the Annual Meeting?

We will pay the entire cost of preparing, assembling, printing, mailing, and distributing these proxy materials and soliciting votes. In addition to the mailing of these proxy materials, the solicitation of proxies or votes may be made in person, by telephone, or by electronic communication by our directors, officers, and employees, who will not receive any additional compensation for such solicitation activities. We may also reimburse brokerage firms, bank, trustee, and other nominees for the cost of forwarding proxy materials to beneficial owners. We have hired Alliance Advisors, LLC ("Alliance Advisors") to help us solicit proxies. We expect to pay Alliance Advisors a base fee of $7,000 plus reimbursement of reasonable out-of-pocket expenses. Proxy solicitations will be made primarily through the mail, but may be supplemented by telephone, facsimile, internet, or personal solicitation by Alliance Advisors.

24. Where can I find the voting results of the Annual Meeting?

We will announce preliminary voting results at the Annual Meeting. We will also disclose voting results on a Current Report on Form 8-K (a "Form 8-K") filed with the SEC within four business days after the Annual Meeting. If final voting results are not available to us in time to file a Form 8-K within four business days after the Annual Meeting, we will file a Form 8-K to publish preliminary results and, within four business days after final results are known, file an additional Form 8-K to publish the final results.

25. What is "householding" and how does it affect me?

We have adopted a procedure approved by the SEC called "householding." Under this procedure, stockholders of record who have the same address and last name will receive only one copy of the Notice unless one or more of these stockholders notifies us that they wish to receive individual copies. Stockholders who participate in householding will continue to be able to request and receive separate proxy cards. This procedure will reduce our printing costs and postage fees.

If you are eligible for householding but you and other stockholders of record with whom you share an address received multiple copies of the Notice, or if you hold stock in more than one account, and, in either case, you wish to receive only a single copy of the Notice for your household, please contact our mailing agent, Broadridge, either by calling (800) 579-1639, via internet at http//www.proxyvote.com, or via email at sendmaterial@proxyvote.com.

If you participate in householding and wish to receive a separate copy of the Notice, or if you do not wish to continue to participate in householding and prefer to receive separate copies in the future, please contact Broadridge as indicated above.

Upon request, we will promptly deliver a separate copy of the Notice and, if applicable, the proxy materials to any stockholder at a shared address to which we delivered a single copy of any of these documents.

Beneficial owners can request information about householding from their broker, banks, trustee, or other nominee.

26. What is the deadline to propose actions for consideration at next year's annual meeting of stockholders or to nominate individuals to serve as directors?

Stockholder Proposals

Stockholders may present proper proposals for inclusion in our proxy statement and for consideration at the next annual meeting of stockholders by submitting their proposals in writing to our corporate secretary in a timely manner. For a stockholder proposal to be considered for inclusion in our proxy statement for our next annual meeting of stockholders, our corporate secretary must receive the written proposal at our principal executive offices not later than January 14, 2021; *provided*, *however*, that in the event that we hold our 2021 annual meeting of stockholders more than 30 days before or 60 days after the one-year anniversary date of the 2020 annual meeting, we will disclose the new deadline by which stockholder proposals must be received under Item 5 of our earliest possible Quarterly Report on Form 10-Q or, if impracticable, by any means reasonably calculated to inform stockholders. In addition, stockholder proposals must otherwise comply with the requirements of Rule 14a-8 of the Securities Exchange Act of 1934, as amended (the "Exchange Act"). Such proposals also must comply with SEC regulations under Rule 14a-8 regarding the inclusion of stockholder proposals in company-sponsored proxy materials. Proposals should be addressed to:

Fluidigm Corporation
Attn: Corporate Secretary
2 Tower Place, Suite 2000
South San Francisco, California 94080

Our bylaws also establish an advance notice procedure for stockholders who wish to present a proposal before an annual meeting of stockholders, but do not intend for the proposal to be included in our proxy statement. Our bylaws provide that the only business that may be conducted at an annual meeting is business that is (i) specified in the Company's proxy materials with respect to such meeting, (ii) otherwise properly brought before the meeting by or at the direction of our Board, or (iii) properly brought before the meeting by a stockholder of record entitled to vote at the annual meeting who has delivered timely written notice to our corporate secretary, which notice must contain the information specified in our bylaws. To be timely for our 2021 annual meeting of stockholders, our corporate secretary must receive the written notice at our principal executive offices:

- not earlier than February 28, 2021, and
- not later than March 30, 2021.

In the event that we hold our 2021 annual meeting of stockholders more than 30 days before or more than 60 days after the one-year anniversary date of the 2020 annual meeting, then notice of a stockholder proposal that is not intended to be included in our proxy statement must be received no earlier than the close of business on the 120th day before such annual meeting and no later than the close of business on the later of the following two dates:

- the 90th day prior to such annual meeting, or
- the 10th day following the day on which public announcement of the date of such meeting is first made.

If a stockholder who has notified us of his, her or its intention to present a proposal at an annual meeting does not appear to present such proposal at such meeting, we are not required to present the proposal for a vote at the meeting.

Nomination of Director Candidates

Our bylaws permit stockholders to nominate directors for election at an annual meeting of stockholders. To nominate a director, the stockholder must provide the information required by our bylaws. In addition, the stockholder must give timely notice to our corporate secretary in accordance with our bylaws, which, in general, require that the notice be received by our corporate secretary within the time described above under "Stockholder Proposals" for stockholder proposals that are not intended to be included in our proxy statement.

In addition, it is the policy of our Nominating and Corporate Governance Committee to consider recommendations for candidates to the Board from stockholders holding not less than one percent (1%) of the outstanding shares of our common stock continuously for at least twelve months prior to the date of submission of the recommendation or nomination. Any such recommendations should include the nominee's name and qualifications for membership on our Board, and should be directed to our corporate secretary at our address set forth above. For additional information regarding stockholder recommendations for director candidates, please see the section entitled "*Corporate Governance and Board of Directors — Process for Recommending Candidates to the Board of Directors*."

Availability of Bylaws

Our bylaws are available on our website at investors.fluidigm.com/corporate-governance/governance-overview. You may also contact our corporate secretary at our principal executive offices for a copy of the relevant bylaw provisions regarding the requirements for making stockholder proposals and nominating director candidates.

CORPORATE GOVERNANCE AND BOARD OF DIRECTORS

Corporate Governance Principles

Our Board has adopted a set of principles that establish the corporate governance policies pursuant to which the Board intends to conduct its oversight of our business in accordance with its fiduciary responsibilities. Among other things, these corporate governance principles address the establishment and operation of Board committees, the role of our chairman, and matters relating to director independence and performance assessments. Our corporate governance principles can be found on our website at http://investors.fluidigm.com by clicking on Governance — Governance Overview.

Role and Composition of the Board

As identified in our corporate governance principles, the role of our Board is to oversee the performance of our CEO and other senior management. Our Board is responsible for hiring, overseeing, and evaluating management while management is responsible for running our day-to-day operations.

Our Board currently has eight members and is divided into three staggered classes of directors. Patrick S. Jones, whose term as a director is expiring effective as of the Annual Meeting, has decided not to stand for reelection at the end of his current term. Additionally, Samuel D. Colella has decided to retire from our Board at the end June 2020. The Board would like to thank Mr. Jones and Mr. Colella for their dedicated service to Fluidigm. In connection with the departures of Mr. Jones and Mr. Colella, the Board has resolved to fix the authorized number of directors at seven, effective as of the Annual Meeting with the elimination of one Class I directorship, and at six, effective upon Mr. Colella's retirement, with the elimination of one Class III directorship. The Board is nominating two nominees for election as Class I directors.

The following table sets forth the names, ages as of May 1, 2020, and certain other information for each of our current directors:

Name	Class	Age	Position	Director Since	Current Term Expires	Expiration of Term For Which Nominated
Nicolas M. Barthelemy(1)(2)	I	54	Director	2017	2020	2023
Bill W. Colston(3)	I	52	Director	2019	2020	2023
Patrick S. Jones(3)(4)	I	75	Director	2011	2020	—
Gerhard F. Burbach(2)(3)	II	58	Director	2013	2021	—
Carlos Paya(1)(2)	II	61	Chairman	2017	2021	—
Laura M. Clague(3)	III	61	Director	2018	2022	—
Samuel D. Colella(1)(5)	III	80	Director	2000	2022	—
Stephen Christopher Linthwaite	III	48	President, CEO, and Director	2016	2022	—

(1) Member of our Nominating and Corporate Governance Committee
(2) Member of our Compensation Committee
(3) Member of our Audit Committee
(4) Mr. Jones is not standing for reelection at the Annual Meeting.
(5) Mr. Colella is retiring from our Board at the end of June 2020.

At each annual meeting of stockholders, a class of directors is elected for a term of three years to succeed the class of directors whose terms are then expiring. The terms of the directors will expire upon the election and qualification of successor directors at the annual meeting of stockholders to be held during the years 2023 for the Class I directors, 2021 for the Class II directors, and 2022 for the Class III directors.

2019 Board Meetings

During 2019, our Board held ten (10) meetings. All of our directors attended at least 75% of the aggregate number of meetings of the Board and of the committees on which they served during the past fiscal year, in each case during the period that he or she served as a director.

Director Attendance at Annual Meeting of Stockholders

Although we do not have a formal policy regarding attendance by members of our Board at annual meetings of stockholders, we encourage all directors to attend. One of the then-six members of our Board attended our 2019 annual meeting of stockholders.

Board Leadership Structure

Our corporate governance principles provide that the Board will fill the chairman and CEO positions based upon the Board's view of what is in our best interests at any point in time. Although our current chairman is a non-employee director, the Board has not adopted any policy requiring separation of the chairman and CEO positions or requiring allocation of the chairman position to a non-employee director. Dr. Carlos Paya, an independent director with substantial board and executive leadership experience, currently serves as our chairman. In addition to Fluidigm, Dr. Paya currently serves on the board of directors of Mallinckrodt plc (Nasdaq:MNK). Our Board believes that Dr. Paya's qualifications to serve as chairman include his experience as a trained immunologist, infectious disease expert and physician, combined with his operating experience as an executive and chief executive officer in the life sciences industry.

Separating the positions of the chairman and CEO allows our CEO to focus on our day-to-day business, while allowing our chairman to lead our Board in its fundamental role providing independent advice to and oversight of management. The Board believes that having an independent director serve as chairman is the appropriate leadership structure for Fluidigm at this time and demonstrates our commitment to good corporate governance.

Director Independence

As a company listed on the Nasdaq Global Select Market ("Nasdaq"), we are required by the Nasdaq listing requirements to maintain a board of directors comprising a majority of "independent directors," as determined affirmatively by our Board. In addition, the Nasdaq rules require that, subject to specified exceptions, each member of our Audit, Compensation, and Nominating and Corporate Governance Committees be independent. In April 2020, our Board undertook a review of the independence of our directors and considered whether any director has a material relationship with us that could compromise his or her ability to exercise independent judgment in carrying out his or her responsibilities. As a result of this review, our Board determined that a majority of our directors are "independent directors" as defined under applicable Nasdaq rules, including Nicolas M. Barthelemy, Gerhard F. Burbach, Laura M. Clague, Bill W. Colston, Samuel D. Colella, Patrick S. Jones, and Carlos Paya. Stephen Christopher Linthwaite is not considered an independent director because of his positions as our President and CEO. There are no family relationships among any of our directors and officers.

Executive Sessions of Independent Directors

In order to promote open discussion among independent directors, our Board has a policy of conducting executive sessions of independent directors during each regularly scheduled board meeting and at such other times as requested by an independent director. These executive sessions are chaired by our chairman. Mr. Linthwaite does not participate in such sessions.

Board's Role in Risk Oversight

While our Board has the ultimate oversight responsibility for the risk management process, it has charged our Audit Committee with responsibility to oversee management's processes for identifying, monitoring, and addressing enterprise risks, evaluate and discuss with management its assessments of matters relating to enterprise risks, and oversee and monitor management's plans to address such risks. Our Audit Committee oversees an enterprise-wide approach to risk management designed to support the achievement of organizational objectives, including strategic objectives, to improve long-term organizational performance, and to enhance stockholder value. A fundamental part of risk management is not only understanding the most significant risks a company faces and what steps management is taking to manage those risks, but also understanding what level of risk is appropriate for a given company. The Audit Committee's review of our business is an integral aspect of its assessment of management's tolerance for risk and its determination as to the appropriate level of risk for our Company.

Our Compensation Committee considers risks related to the attraction and retention of talent and risks related to the design of compensation programs and arrangements. In setting compensation, the Compensation Committee strives to create incentives that encourage a level of risk-taking consistent with our business strategy and to encourage a focus on building long-term value that does not encourage excessive risk-taking. In connection with its oversight of compensation-related risks, our Compensation Committee has reviewed our compensation programs and practices for employees, including executive and non-executive programs and practices. In its review, our Compensation Committee evaluated whether our policies and programs encourage unnecessary or excessive risk-taking and controls, and how such policies and programs are structured with respect to risks and rewards, as well as controls designed to mitigate any risks. As a result of this review, our Compensation Committee determined that any risks that may result from our compensation policies and practices for our employees are not reasonably likely to have a material adverse effect on Fluidigm.

Our Nominating and Corporate Governance Committee assists our Board in fulfilling its oversight responsibilities with respect to the management of risk associated with corporate governance and board organization, membership, and structure.

At periodic meetings of the Board and its committees and in other meetings and discussions, management reports to, and seeks guidance from, the Board and its committees with respect to the most significant risks that could affect our business, such as legal, financial, tax, audit, and cybersecurity-related risks. In addition, among other matters, management provides our Audit Committee periodic reports on our compliance programs and efforts, and investment policy and practices.

Board Committees

Our Board has three standing committees: an Audit Committee, a Compensation Committee, and a Nominating and Corporate Governance Committee. Each committee operates under a written charter approved by our Board that satisfies the applicable standards of the SEC and Nasdaq. The committee charters are available on our website at http://investors.fluidigm.com by clicking on Governance – Governance Overview.

The table below shows the members and chairs of each committee and the number of meetings held in 2019.

	Audit	Compensation	Nominating and Corporate Governance
Nicolas M. Barthelemy	X(1)	C(2)	X(1)
Gerhard F. Burbach	X	X(2)	
Laura M. Clague	X(3)		
Samuel D. Colella		X(4)	X(5)
Bill W. Colston	X		
Patrick S. Jones	C(3)		
Carlos Paya		X(4)	C(5)
Meetings in 2019	6	5	5

C = Chair

(1) Mr. Barthelemy stepped down from our Audit Committee and joined our Nominating and Corporate Governance Committee in October 2019.
(2) Mr. Barthelemy was appointed to replace Mr. Burbach as chair in June 2019.
(3) Board-designated "audit committee financial expert" under SEC rules.
(4) Mr. Colella left and Dr. Paya joined our Compensation Committee in October 2019.
(5) Dr. Paya was appointed to replace Mr. Colella as chair in February 2019.

Audit Committee. Our Audit Committee is currently chaired by Patrick S. Jones; Laura M. Clague has been appointed to succeed Mr. Jones as Audit Committee chair effective as of the Annual Meeting. Our Board has determined that each member of the Audit Committee is independent and financially literate under the current rules and regulations of the SEC and Nasdaq and that Mr. Jones and Ms. Clague each qualify as an "audit committee financial expert" within the meaning of the rules and regulations of the SEC.

The Audit Committee oversees our corporate accounting and financial reporting process and our enterprise risk management process, and assists our Board in monitoring our financial systems and our legal and regulatory compliance. Our Audit Committee is authorized to, among other things:

- oversee the work of our independent registered public accounting firm;
- approve the hiring, discharge, and compensation of our independent registered public accounting firm;
- approve engagements of our independent registered public accounting firm to render any audit or permissible non-audit services;
- evaluate the qualifications, independence, and performance of our independent registered public accounting firm;
- discuss and, as appropriate, review with management and our independent registered public accounting firm our annual and quarterly financial statements and our major critical accounting policies and practices;
- review management's assessment of our internal controls; and
- review the adequacy and effectiveness of our internal control policies and procedures.

Compensation Committee. Our Compensation Committee is currently chaired by Nicolas M. Barthelemy. Each member of the Compensation Committee is an independent director under the applicable rules and regulations of the SEC and Nasdaq, a nonemployee director as defined in Rule 16b-3 promulgated under the Exchange Act, and an outside director as defined pursuant to Section 162(m) of the U.S. Internal Revenue Code, as amended. Furthermore, if required to ensure compliance with Rule 16b-3 under the Exchange Act, a subcommittee of the Compensation Committee or the Board considers and approves the grant of equity awards to our executive officers.

The Compensation Committee oversees our corporate compensation programs and is authorized to, among other things:

- review the compensation and benefits of our CEO and other executive officers;
- review our corporate goals and objectives relevant to the compensation of our CEO;
- assist our Board in providing oversight of the Company's overall compensation plans and benefits program; and
- administer our equity incentive plans.

Please see the sections entitled "*Executive Compensation*" and "*Compensation of Non-Employee Directors*" for a description of our processes and procedures for the consideration and determination of executive and director compensation.

Nominating and Corporate Governance Committee. Our Nominating and Corporate Governance Committee is currently chaired by Carlos Paya. Our Board has determined that each member of our Nominating and Corporate Governance Committee is an independent director under the applicable rules and regulations of the SEC and Nasdaq.

Our Nominating and Corporate Governance Committee oversees and assists our Board in reviewing and recommending nominees for election as directors and oversees our corporate governance matters. Among other things, the Nominating and Corporate Governance Committee is authorized to:

- evaluate and make recommendations regarding the composition, organization, and governance of the Board and its committees;
- evaluate the performance of members of the Board and make recommendations regarding committee and chair assignments;
- recommend desired qualifications for Board membership and conduct searches for potential members of the Board;
- review and recommend Board compensation programs for outside directors; and
- develop and make recommendations with regard to our corporate governance guidelines.

The Nominating and Corporate Governance Committee also reviews our initiatives with respect to sustainability and corporate responsibility, including environmental and social matters.

Compensation Committee Interlocks and Insider Participation

None of the members of our Compensation Committee during our last fiscal year (which included Nicolas M. Barthelemy, Gerhard F. Burbach, Samuel D. Colella (until October 2019), and Carlos Paya) is, or was during 2019, an officer or employee of our Company. None of our executive officers currently serves, or in the past year has served, as a member of the board of directors or compensation committee of any entity that has one or more executive officers serving on our Board or Compensation Committee.

Considerations in Identifying and Evaluating Director Nominees

Our Nominating and Corporate Governance Committee has established policies and procedures relating to the consideration of any individual recommended as a prospective director nominee from stockholders. Please see the section entitled "*Process for Recommending Candidates to the Board of Directors*" below for details. The Nominating and Corporate Governance Committee will consider candidates recommended by stockholders in the same manner as candidates recommended to the Committee from other sources.

The Nominating and Corporate Governance Committee is responsible for determining the criteria for membership to our Board and recommending candidates for election to the Board. In its evaluation of director candidates, including the members of the Board eligible for reelection, our Nominating and Corporate Governance Committee considers the following:

- the current size and composition of our Board and the needs of the Board and its respective committees;
- factors such as character, integrity, judgment, diversity of background (including gender, race, and ethnicity) and experience, independence, area of expertise, corporate experience, length of service, potential conflicts of interest, other commitments, and the like; and
- other factors that our Nominating and Corporate Governance Committee may consider appropriate.

Any nominee for a position on the Board must satisfy the following minimum qualifications:

- the highest personal and professional ethics and integrity;
- proven achievement and competence in the nominee's field and the ability to exercise sound business judgment;
- skills that are complementary to those of the existing Board;
- the ability to assist and support management and make significant contributions to the Company's success; and
- an understanding of the fiduciary responsibilities required of a member of the Board and the commitment of time and energy necessary to diligently carry out those responsibilities.

If our Nominating and Corporate Governance Committee determines that an additional or replacement director is required, the Nominating and Corporate Governance Committee may take such measures as it considers appropriate in connection with its evaluation of a director candidate, including candidate interviews, inquiry of the person or persons making the recommendation or nomination, engagement of an outside search firm to gather additional information, or reliance on the knowledge of the members of the Committee, Board, or management. We have retained a third-party search firm to assist with the identification and evaluation of qualified candidates to serve on the Board.

Board Diversity

Our director nominating policies include specific references to factors relating to diversity, such as diversity of gender, race and national origin, education, professional experience, and differences in viewpoints and skills. Our Nominating and Corporate Governance Committee believes that it is essential that the board members represent diverse viewpoints and considers these factors in its deliberations over Board expansion and potential candidates.

Under California Senate Bill 826 adopted in 2018, because we are a public company with our principal executive office located in the State of California, we are required to meet certain requirements with respect to the number of women on the Board. We were required to have one woman director by the end of 2019 and will be required to have three women directors by the end of 2021. Our Nominating and Corporate Governance Committee is conducting an active search for additional women candidates to join the Board.

Process for Recommending Candidates to the Board of Directors

It is the policy of our Nominating and Corporate Governance Committee to consider recommendations for candidates to the Board from stockholders holding not less than one percent (1%) of the outstanding shares of our common stock continuously for at least twelve months prior to the date of submission of the recommendation or nomination. Stockholder recommendations for candidates to the Board must be directed in writing to Fluidigm Corporation, 2 Tower Place, Suite 2000, South San Francisco, California 94080, Attention: Corporate Secretary, and must include the candidate's name, home and business contact information, detailed biographical data, relevant qualifications, a signed letter from the candidate confirming willingness to serve, information regarding any relationships between the candidate and Fluidigm, and evidence of the recommending stockholder's ownership of our stock. Such recommendations must also include a statement from the recommending stockholder in support of the candidate, particularly within the context of the criteria for Board membership, including issues of character, integrity, judgment, diversity of background and experience, independence, area of expertise, corporate experience, length of service, potential conflicts of interest, other commitments, and the like, and personal references. For details regarding the process to nominate a director directly for election to the Board at an annual meeting of the stockholders, please see item 26 of the *General Information* section entitled "*What is the deadline to propose actions for consideration at next year's annual meeting of stockholders or to nominate individuals to serve as directors? - Nomination of Director Candidates*."

Code of Ethics and Conduct

We are committed to the highest standards of integrity and ethics in the way we conduct our business. We have adopted a code of ethics and conduct that applies to the members of our Board, our officers and employees (including our CEO, Chief Financial Officer, and Principal Accounting Officer), as well as our agents, contractors, and consultants. Our code of ethics and conduct establishes our policies and expectations with respect to a wide range of business conduct, including preparation and maintenance of financial and accounting information, compliance with laws, and conflicts of interest.

Under our code of ethics and conduct, each of our directors, officers, and employees is required to report suspected or actual violations to the extent permitted by law. In addition, we have adopted separate procedures concerning the receipt and investigation of complaints relating to accounting or audit matters. These procedures have been adopted and are administered by our Audit Committee.

Our code of ethics and conduct can be found on our website at http://investors.fluidigm.com by clicking on Governance — Governance Overview. When required by the rules of the SEC or Nasdaq, we will disclose any future amendment to, or waiver of, any provision of the code of ethics and conduct for our CEO, Principal Financial Officer, Principal Accounting Officer, or any member of our Board on our website at http://investors.fluidigm.com in the Governance Overview section, within four business days following the date of such amendment or waiver.

Stockholder Engagement

We believe that understanding the perspective of our stockholders is a key component of good corporate governance and we are committed to an active and robust stockholder engagement program. The goals of our stockholder engagement program are to:

- provide transparency and visibility into our strategy, our financial and operational performance, and our governance practices;
- determine which issues are important to our stockholders and share our views on those issues; and
- discuss and seek feedback on our business, executive compensation, and corporate governance policies and practices.

We engage with stockholders year-round, involving our investor relations team, senior management, and our chairman or Board committee chairs as appropriate and/or requested. This includes participating in investor conferences, industry and formal events, in person one-on-one meetings, and conference calls throughout the year.

During 2019 and continuing into 2020, we solicited engagement with stockholders representing over 50 percent of our outstanding shares to request their feedback on our business strategy, company history, financial performance, governance, additions to the Board, and executive compensation programs. Members of our investor relations team and executive management have reached out to our largest active stockholders and spoken with those expressing concerns, with members of our Board joining certain discussions.

This dialogue has informed our Board's meeting agendas, and led to governance enhancements that help us address the issues that matter most to our stockholders. In response to investor feedback, we implemented changes in guidance and our guidance financial metrics for fiscal 2020, enhanced our executive compensation practices, and implemented new policies formalizing our commitment to sound corporate social responsibility practices.

Communications with the Board

Stockholders who wish to communicate with our Board are welcome to do so either (i) in writing, addressed to: Fluidigm Corporation, 2 Tower Place, Suite 2000, South San Francisco, California 94080, Attn: Corporate Secretary, or (ii) by going online to http://investors.fluidigm.com and clicking on Governance — Contact the Board. Communications are distributed to our Board, or to any individual directors as appropriate, depending on the facts and circumstances outlined in the communication.

Corporate Responsibility and Sustainability

Our mission is to improve life through comprehensive health insight. Our cutting-edge biotechnology tools empower researchers to deepen human understanding of health and disease and accelerate the development of therapies to increase the quality of all life. Consistent with this mission, we strive to conduct our business in a manner that demonstrates our respect for the environment in which we live and operate and our concern for the health and safety of the personnel throughout our organization and supply chain.

In 2019, at the recommendation of our Nominating and Corporate Governance Committee, our Board adopted:

- an enterprise-level environment, health, and safety policy,
- a statement of commitment to doing business responsibly by aligning our strategies and global operations with the United Nations Global Compact principles on human rights, labor laws, environmental protection, and corruption in business,
- a supply chain transparency and anti-slavery statement, and
- a business partner code of conduct formally defining our expectations for our distributors, suppliers, vendors, contractors, agents, and all other third parties who provide products or services to us.

These policies and statements can be found on our website at http://investors.fluidigm.com/social-responsibility. The development of our environmental, health, safety, and social responsibility programs is ongoing. We will provide updates and additional information on our website as we move forward.

COMPENSATION OF NON-EMPLOYEE DIRECTORS

Compensation Policy

Non-employee directors receive an annual retainer for service on our Board and an annual retainer for service on committees of the Board as set forth below:

Annual cash retainer for each non-employee director	$	40,000
Annual cash retainer for each Audit Committee member	$	10,000
Annual cash retainer for each Compensation Committee member	$	7,000
Annual cash retainer for each Nominating and Corporate Governance Committee member	$	5,000
Additional cash retainer for chairmanship of the Board	$	40,000
Additional cash retainer for chairing the Audit Committee	$	10,000
Additional cash retainer for chairing the Compensation Committee	$	8,000
Additional cash retainer for chairing the Nominating and Corporate Governance Committee	$	5,000

We have also adopted an outside director equity compensation policy (the "Compensation Policy") to formalize the granting of equity compensation to non-employee directors under the 2011 Plan. As amended in April 2019, the Compensation Policy provides for automatic equity awards as set forth below:

		Grant Date Value:	
Type of Award	**Description**	**Restricted Stock Units (RSUs)**	**Stock Options**
Initial Awards	Granted to new non-employee directors upon initial election / appointment	$55,000	$55,000
Annual Awards	Granted to continuing non-employee directors on the date of each annual meeting of the Company's stockholders following election / appointment	$50,000	$50,000

Non-employee directors are eligible to receive all types of awards under the 2011 Plan except for incentive stock options, and may receive discretionary awards not covered by the Compensation Policy.

The exercise price of all stock options granted pursuant to the Compensation Policy will be 100% of the fair market value of our common stock on the date of grant and the term of all stock options will be ten years.

All awards granted to non-employee directors under the 2011 Plan are subject to vesting, conditioned upon the recipient's continued service on the board through the applicable vesting date, as set forth below.

- Initial option awards and initial restricted stock unit ("RSU") awards vest in equal annual installments over four years.
- Annual option awards vest and become exercisable in 12 equal monthly installments.
- Annual RSU awards vest in full on the earlier to occur of (i) the first anniversary of the grant date and (ii) one day prior to the date of the Company's next annual meeting of stockholders.

Non-employee directors are permitted to defer the settlement of their vested RSU awards-including RSUs elected in lieu of cash retainers-until the earlier to occur of (i) a qualifying change in control and (ii) termination of service as a board member.

The administrator of the 2011 Plan, in its discretion, may change or otherwise revise the terms of awards granted under the Compensation Policy.

In the event of a "change of control" as defined in the 2011 Plan, all unvested equity awards then held by non-employee directors will vest fully and become exercisable as to all shares thereunder regardless of performance goals, vesting criteria, or other conditions.

RSUs in Lieu of Cash and RSU Deferral

Non-employee directors have the option to elect to receive an RSU award in lieu of 100% of their annual cash retainers payable for services to be rendered as a non-employee director, chairperson of the board, or chair or member of any Board committee. RSUs elected in lieu of payments in cash vest quarterly but settlement of such RSUs can be deferred as described below.

Each non-employee director may elect to defer settlement of his or her RSU grants until the earlier of the termination of his or her service on our Board or a qualifying change in control.

Non-Employee Director Stock Ownership Guidelines

Our Board has approved stock ownership guidelines for our non-employee directors to further align their interests with the interests of our stockholders.

Pursuant to the guidelines, each non-employee director is expected to accumulate and hold a number of shares of our common stock equal to the lesser of (i) that number of shares with a value equal to three times his or her Board cash retainer or (ii) 19,540 shares, and to maintain this minimum amount of stock ownership during the director's tenure on the Board. For purposes of determining stock ownership pursuant to the guidelines, we include shares owned outright and vested in-the-money stock options, but do not include value or shares attributable to unvested time vesting restricted stock, unvested and/or out-of-the money stock options and/or unearned performance shares. Our non-employee directors are expected to achieve the applicable level of ownership by the end of the fiscal year that follows the five-year anniversary of the date he or she becomes covered by the guidelines.

Non-employee directors are not required to purchase shares on the open market in order to comply with the guidelines. In the event a non-employee director falls out of compliance with the guidelines at any time, he or she will be required to maintain 50% of the shares (net of tax and exercise costs) acquired through the vesting or exercise of awards until the guidelines are again satisfied. The guidelines include a once-met-always-met policy such that each non-employee director will be deemed to satisfy the guideline if they hold at least the number of shares that, as of the first measurement date they comply with the guidelines, was equal to the guideline value (i.e., following the initial compliance, the policy for each non-employee director will reset to the lesser of the guideline value or the number of shares that originally satisfied the guideline).

2019 Director Compensation

The following table sets forth information concerning compensation paid or accrued for services rendered to us by members of our Board for the year ended December 31, 2019. The table excludes Mr. Linthwaite, who was a named executive officer and did not receive any compensation from us in his role as a director in 2019.

	Fees Earned or Paid in Cash ($)	Stock Awards ($)(1)	Option Awards ($)(1)	Total ($)
Nicolas M. Barthelemy	59,750	53,466	49,999	163,215
Gerhard F. Burbach	61,000	53,466	49,999	164,465
Laura M. Clague	50,000	53,466	49,999	153,465
Samuel D. Colella	96,993(2)	53,466	49,999	200,458
Bill W. Colston	22,500	53,811	54,998	131,309
Patrick S. Jones	60,000	53,466	49,999	163,465
Carlos Paya	50,494(2)	53,466	49,999	153,959

(1) Amounts represent the aggregate grant date fair value of the option award and RSU awards, as applicable, calculated in accordance with Financial Accounting Standards Board ASC Topic 718, Stock Compensation, as amended, without regard to estimated forfeitures. See Note 9 of the notes to our audited consolidated financial statements included in our Annual Report on Form 10-K for the year ended December 31, 2019 for a discussion of valuation assumptions made in determining the grant date fair value and compensation expense of our stock options and RSU awards.

(2) Amount includes RSUs received in lieu of cash fees for 2019.

Director Equity Awards

The aggregate numbers of shares underlying stock options and RSUs outstanding at December 31, 2019 for each non-employee director were as follows:

	Aggregate Number of Shares Underlying Stock Options Outstanding as of December 31, 2019	Aggregate Number of Shares Underlying RSUs Outstanding as of December 31, 2019
Nicolas M. Barthelemy	40,396	8,987
Gerhard F. Burbach	92,396	34,202(1)
Laura M. Clague	21,796	13,987(1)
Samuel D. Colella	26,796	3,987
Bill W. Colston	8,724	4,663
Patrick S. Jones	116,396	3,987
Carlos Paya	40,396	8,987

(1) Amount includes RSUs with respect to which settlement has been deferred.

PROPOSAL NUMBER 1

ELECTION OF CLASS I DIRECTORS

Board Structure

Our Board currently has eight members and is divided into three staggered classes of directors. Patrick S. Jones is not standing for reelection at the Annual Meeting and Samuel D. Colella is retiring from our Board at the end of June 2020. Our Board has resolved to fix the authorized number of directors at seven, effective as of the Annual Meeting, with the elimination of one Class I directorship, and at six, effective upon Mr. Colella's retirement, with the elimination of one Class III directorship. At each annual meeting of stockholders, a class of directors is elected for a term of three years to succeed the class of directors whose terms are then expiring. The terms of the directors will expire upon the election and qualification of successor directors at the annual meeting of stockholders to be held this year for the Class I directors, in 2021 for the Class II directors, and in 2022 for the Class III directors.

Nominees for Class I Directors (Term Expiring in 2023)

At the 2020 Annual Meeting, two Class I directors will be elected to the Board by the holders of our common stock. Our Nominating and Corporate Governance Committee recommended, and our Board nominated, Nicolas M. Barthelemy and Bill W. Colston, each a current Class I director, as nominees for reelection as Class I directors at the 2020 Annual Meeting.

Mr. Barthelemy and Dr. Colston have each agreed to serve if elected, and management has no reason to believe that they will be unavailable to serve. In the event a nominee is unable or declines to serve as a director at the time of the 2020 Annual Meeting, proxies will be voted for any nominee who may be proposed by the Nominating and Corporate Governance Committee and designated by the present Board to fill the vacancy.

Biographical Information Concerning the Class I Director Nominees

Nicolas M. Barthelemy, age 54, has served as a member of our Board since March 2017. Mr. Barthelemy brings over 25 years of health-care industry experience to the director role. From 2014 to February 2017, Mr. Barthelemy served as the president and chief executive officer of Biotheranostics, Inc., a molecular diagnostics company. From 2010 until 2013, he served as president, global commercial operations at Life Technologies Corporation, a global life sciences company, which was acquired by Thermo Fisher Scientific Inc. in February 2014. Prior to that position, he led the $850M Cell Systems division from 2005 to 2010. Before Life Technologies, from 1996 to 2004, Mr. Barthelemy was with Biogen Inc., a biotechnology company, most recently as vice president, manufacturing. He began his career with Merck & Co., Inc. (NYSE: MRK), a pharmaceutical company, as a project engineer in the vaccine division and worked for the company from 1991 to 1996. From January 2018 to November 2018, Mr. Barthelemy served on the board of directors of Genewiz (privately held), a biotechnology company. Mr. Barthelemy currently serves as a member of the boards of directors of Repligen Corporation (Nasdaq: RGEN), 908 Devices Inc. (privately held), Biocare Medical, LLC (privately held), and of Twist Bioscience Corporation (Nasdaq: TWST). All four companies are in the life sciences sector. He received an M.S. in Chemical Engineering from the University of California, Berkeley in 1991, and an engineering degree from Ecole Superieure de Physique et Chimie Industrielles, Paris in 1989. We believe that Mr. Barthelemy's extensive experience in manufacturing, distributing and commercializing life science instruments, reagents and services, his knowledge of the research and clinical markets as well as his relevant public board experience qualify him to serve on our Board.

Bill W. Colston, age 52, has served as a member of our Board since July 2019. In 2018, Dr. Colston joined iCarbonX Inc., a privately held China-based company offering an artificial intelligence platform for health data, and currently serves as its president and a member of its board of directors. From 2011 to until its acquisition by iCarbonX in April 2018, Dr. Colston served as chief executive officer, co-founder, and a member of the board of directors of HealthTell Inc., a company focused on developing next generation tests that broadly characterize the immune system. From 2008 until 2012, Dr. Colston served as scientific founder, chief executive officer, and a member of the board of directors of QuantaLife Inc., a biotechnology startup company that developed a genetic analysis system and was acquired by Bio-Rad Laboratories, Inc. in 2011. From 1998 to 2008, Dr. Colston served in various senior leadership roles with Lawrence Livermore National Security Laboratory. In addition to his service on the iCarbonX board of directors, Dr. Colston currently serves on the boards of directors of RubrYc Therapeutics, Inc. and Purigen Biosystems, Inc., private companies in the fields of life sciences and biotechnology. A prolific scientific writer and inventor, he has authored numerous publications and patents. Dr. Colston received his B.A. in biology/biological sciences from the University of Texas at Austin in May 1989, and his Ph.D. in biomedical engineering from the University of California, Davis, in December 1997. We believe that Dr. Colston's scientific background and his extensive experience in the life sciences and biotechnology industries qualify him to serve on our Board.

Required Vote

The Class I directors elected to the Board will be elected by a plurality of the votes present in person or represented by proxy and entitled to vote on the election of directors. In other words, the two nominees receiving the highest number of "FOR" votes will be elected as Class I directors. Abstentions and broker non-votes will not affect the outcome of the election of the Class I directors. Shares represented by executed proxies will be voted, if authority to do so is not expressly withheld (as indicated on the proxy card), for the election of Nicolas M. Barthelemy and Bill W. Colston.

Recommendation

Our Board recommends a vote "FOR" the election to the Board of each of Nicolas M. Barthelemy and Bill W. Colston as Class I directors.

Continuing Class II Directors (Term Expiring in 2021)

Gerhard F. Burbach, age 58, has been a member of our Board since January 2013. Mr. Burbach currently serves as chairman of the board of directors of Procyrion Inc., a private medical device company focused on the treatment of chronic heart failure, and as a member of the boards of directors of Vascular Dynamics, a private medical device company focused on the treatment of hypertension, and BWX Technologies, Inc. (NYSE: BWXT), a company that manufactures and supplies nuclear components and fuel. Mr. Burbach served on the board of directors of Autonomic Technologies, Inc., a private medical device company focused on the treatment of severe headaches, from December 2015 to April 2019, including service as chairman of the board beginning April 2016 and as interim chief executive officer and president from December 2015 to April 2016. From January 2006 to September 2014, Mr. Burbach served as president, chief executive officer, and director of Thoratec Corporation (Nasdaq: THOR), a company that develops, manufactures, and markets proprietary medical devices used for circulatory support. In addition, from 2004 to February 2013, Mr. Burbach served as a member of the board of directors of Digirad Corporation (Nasdaq: DRAD), a company focused on diagnostic imaging products. From April 2005 to January 2006, Mr. Burbach served as president and chief executive officer of Digirad Corporation. From July 2003 to April 2005, he served as president and chief executive officer of Bacchus Vascular, Inc., a developer of catheter-based medical devices. From January 2001 to July 2003, he served as chief executive officer of Philips Nuclear Medicine, a division of Philips Electronics, and before its acquisition by Philips, he worked for four years for ADAC Laboratories, most recently as president. Mr. Burbach also spent six years with the management consulting firm of McKinsey & Company, Inc., where he was most recently a senior engagement manager in the firm's healthcare practice. Mr. Burbach received a B.S. in Industrial Engineering from Stanford University in 1984 and an M.B.A. from Harvard business School in 1990. We believe that Mr. Burbach's experience as a chief executive officer and director of other public life sciences companies qualifies him to serve on our Board.

Carlos Paya, M.D., Ph.D., age 61, has been a member of our Board since March 2017 and has served as the chairman of our Board since May 2020. Dr. Paya currently serves on the board of directors of Mallinckrodt plc (Nasdaq: MNK), a manufacturer of specialty pharmaceutical products and diagnostic imaging agents. From May 2011 to June 2019, Dr. Paya served as president, chief executive officer and director of Immune Design Corp., an immunotherapy company acquired by Merck & Co. in 2019. He previously served as president of Elan Corporation, a pharmaceutical corporation that was acquired by Perrigo Company, from November 2008 to April 2011. Before joining Elan Corporation, Dr. Paya was at Eli Lilly & Company, a pharmaceutical corporation, from September 2001 to November 2008 as vice president, Lilly Research Laboratories. From January 1991 to August 2001, Dr. Paya was professor of medicine, immunology, and pathology, and vice dean of the clinical investigation program at the Mayo Clinic in Rochester, Minnesota. He received his M.D. and Ph.D. degrees from the University of Madrid and underwent postdoctoral training at the Institute Pasteur, Paris, France. We believe that Dr. Paya's experience in the life sciences industry gives him the qualifications and skills to serve on our Board.

Continuing Class III Directors (Term Expiring in 2022)

Laura M. Clague, age 61, has been a member of our Board since October 2018. Ms. Clague has served as the senior vice president and chief financial officer of Retrophin, Inc. since November 2014. Ms. Clague previously served as the chief financial officer of the San Diego and Ohio operations of Amylin Pharmaceuticals, Inc., a wholly owned subsidiary of Bristol-Myers Squibb. Prior to the acquisition by Bristol-Myers Squibb in 2012, Ms. Clague was the vice president, corporate controller and chief accounting officer of Amylin for 10 years, and during this time also served as the chief financial officer of the Amylin/Lilly Collaboration. From 1988 to 1999, Ms. Clague was the director of finance and accounting operations for Sony Electronics, Inc. From 1985 to 1988, Ms. Clague served as internal audit supervisor at Cubic Corporation. From 1982 to 1985, Ms. Clague held various audit positions at KPMG. Ms. Clague also serves on the board of directors of Genasys Inc. (formerly LRAD Corporation), where she chairs the audit committee. Ms. Clague is a certified public accountant in the State of California, and has a B.S. in Business Administration from Menlo College. We believe that Ms. Clague's extensive background in finance and accounting and her experience in the life sciences industry qualify her to serve on our Board.

Stephen Christopher Linthwaite, age 48, joined Fluidigm as President and Chief Operating Officer in August 2016 and has served as our President and CEO and as a member of our Board since October 2016. From August 2003 to April 2016, Mr. Linthwaite held various managerial positions at Thermo Fisher Scientific Inc., a life sciences company, and prior to its acquisition by Thermo Fisher, at Life Technologies Corporation, a life sciences company, including president, genetic sciences division, from December 2014 to April 2016, president, genetic analysis platform, from September 2011 to December 2014, and various other managerial positions at Invitrogen prior to the creation of Life Technologies through a merger of Invitrogen and Applied Biosystems. Prior to joining Invitrogen, Mr. Linthwaite held various strategic consulting roles. Mr. Linthwaite served on the board of directors of Claritas Genomics, Inc. from December 2014 to April 2016. Mr. Linthwaite received an M.B.A. from the University of Virginia (Darden) School of Business, and a B.A. in Foreign Affairs from the University of Virginia. Prior to business school, Mr. Linthwaite served on active duty in the U.S. Army as an armor officer. We believe that Mr. Linthwaite's extensive industry experience with life sciences companies qualifies him to serve on our Board.

Non-Continuing Directors

Patrick S. Jones, age 75, has served as a member of our Board since March 2011. Mr. Jones has been a private investor since March 2001. Mr. Jones currently serves on the board of directors of Talend SA (Nasdaq: TLND), a data integration software company, Itesoft SA (PAR: ITE.PA), a business process automation software company, and Galileo Acquisition Corp. (Nasdaq: GLEO), a special purpose acquisition company. From 2003 to May 2018, Mr. Jones served as chairman of Inside Secure SA (PAR: INSD.PA), a company that makes digital security solutions. From 2005 to May 2015, Mr. Jones served on the board of directors of Lattice Semiconductor Corporation (Nasdaq: LSCC), a fabless semiconductor company. From 2012 to 2013, Mr. Jones served as chairman of Dialogic Inc. (OTC: DLGC), a communications technology company. From 2005 to 2012, Mr. Jones served as chairman of Epocrates, Inc., a provider of clinical solutions to healthcare professionals and interactive services to the healthcare industry, which was acquired by athenahealth, Inc. in 2013. From 2007 to 2012, Mr. Jones also served on the board of directors of Openwave Systems Inc., a telecom infrastructure software provider that changed its name to Unwired Planet (Nasdaq: UPIP) in 2012. From 2007 to 2011, Mr. Jones served on the board of directors of Novell, Inc., an enterprise infrastructure software provider that was sold to Attachmate Corporation in 2011. From June 1998 to March 2001, Mr. Jones was the senior vice president and chief financial officer of Gemplus International S.A. (now GEMALTO N.V.), a provider of solutions empowered by smart cards. From March 1992 to June 1998, he was vice president of finance and corporate controller at Intel Corporation, a producer of microchips and communications products. Prior to that, Mr. Jones served as chief financial officer of LSI Corporation (formerly known as LSI Logic), a semiconductor company. Mr. Jones received a B.A. from the University of Illinois and an M.B.A. from St. Louis University. We believe that Mr. Jones's significant financial and accounting expertise and international business experience qualify him to serve on our Board. As previously disclosed in our Current Report on Form 8-K filed on May 7, 2020, Mr. Jones notified the Company that he will continue to serve as a member of our Board until the expiration of his term at our 2020 Annual Meeting. Mr. Jones's decision to not stand for reelection is not the result of any disagreement with Fluidigm relating to any of our operations, policies or practices.

Samuel D. Colella, age 80, has served as a member of our Board since July 2000 and as chairman of the Board from July 2000 to May 2020. Mr. Colella is a managing director of Versant Ventures, a healthcare venture capital firm he co-founded in 1999, and has been a general partner of Institutional Venture Partners since 1984. Mr. Colella currently serves on the board of directors of Flexion Therapeutics, Inc. (Nasdaq: FLXN), a specialty pharmaceutical company. Mr. Colella also is currently a member of the boards of directors of several private companies. Mr. Colella served on the board of directors of Genomic Health, Inc. (Nasdaq: GHDX), a molecular diagnostics company, from 2001 to 2014; Alexza Pharmaceuticals, Inc. (Nasdaq: ALXA), a pharmaceutical company, from 2002 to 2012; Jazz Pharmaceuticals, Inc. (Nasdaq: JAZZ), a biopharmaceutical company, from 2003 to 2012; and Veracyte, Inc. (Nasdaq: VCYT), a diagnostics company, from 2006 to 2014. Mr. Colella received a B.S. in business and engineering from the University of Pittsburgh and an M.B.A. from Stanford University. We believe that Mr. Colella's broad understanding of the life science industry and his extensive experience working with emerging private and public companies, including prior service as chairman of boards of directors, qualifies him to serve on our Board. As previously disclosed in our Current Report on Form 8-K filed on May 7, 2020, Mr. Colella notified the Company that he will retire as a member of our Board effective June 30, 2020. Mr. Colella's decision to retire from our Board is not the result of any disagreement with Fluidigm relating to any of our operations, policies or practices.

PROPOSAL NUMBER 2

ADVISORY VOTE ON EXECUTIVE COMPENSATION

At our 2017 annual meeting of stockholders, our Board recommended and our stockholders approved holding an advisory vote on the compensation of our named executive officers every year: we believe an annual vote allows for a meaningful evaluation period of performance against our compensation practices. Accordingly, as required by Section 14A of the Exchange Act, we are asking our stockholders to cast an advisory vote to approve the compensation of our named executive officers as described in this proxy statement.

We encourage you to read our Compensation Discussion and Analysis beginning on page 35, which describes in more detail how our executive compensation program operates and is designed to achieve our goals, as well as the compensation tables and narrative beginning on page 50, which provide detailed information on the compensation of our named executive officers.

Compensation Program and Philosophy

The primary goal of our executive compensation program is to ensure that we hire and retain talented and experienced executive officers who are motivated to achieve or exceed our short-term and long-term corporate goals. Our compensation philosophy is team-oriented and our success is dependent on what our management team can accomplish together. Therefore, we seek to provide our non-CEO executive officers with comparable levels of base salary, bonuses, and annual equity awards that are based largely on overall company performance.

In determining the form and amount of compensation payable to our executive officers, we are guided by the following objectives and principles:

- Team-oriented approach to establishing compensation levels;
- Compensation should relate to performance;
- Equity awards help executive officers think like stockholders; and
- Total compensation opportunities should be competitive.

Our Board believes that our current executive compensation program has been effective at linking executive compensation to our performance and aligning the interests of our executive officers with those of our stockholders. We are asking our stockholders to indicate their support for the compensation of our named executive officers as described in this proxy statement by voting in favor of the following resolution:

"RESOLVED, that the stockholders approve, on an advisory basis in a non-binding vote, the compensation of Fluidigm Corporation named executive officers as disclosed pursuant to Item 402 of Securities and Exchange Commission Regulation S-K, including the Compensation Discussion and Analysis, the compensation tables, and narrative disclosures set forth in the proxy statement relating to Fluidigm's 2020 Annual Meeting of Stockholders."

Required Vote

The affirmative "FOR" vote of a majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the proposal is required to approve, on an advisory basis, the compensation awarded to named executive officers for the year ended December 31, 2019. You may vote "FOR," "AGAINST," or "ABSTAIN" on this proposal. Abstentions have the same effect as a vote against the proposal. Broker non-votes are not included in the tabulation of voting results on this proposal, and will not affect the outcome of voting on this proposal.

Although this say-on-pay vote is advisory and, therefore, will not be binding on us, our Compensation Committee and our Board value the opinions of our stockholders. Accordingly, to the extent there is a significant vote against the compensation of our named executive officers, we will consider our stockholders' concerns, and the Compensation Committee will evaluate what actions may be necessary or appropriate to address those concerns.

Recommendation

Our Board recommends a vote "FOR" the approval, on an advisory basis, of the compensation of our named executive officers as disclosed in this proxy statement.

PROPOSAL NUMBER 3

APPROVAL OF AMENDMENT AND RESTATEMENT OF THE 2017 EMPLOYEE STOCK PURCHASE PLAN

We are asking our stockholders to approve an amendment and restatement of our ESPP (the "Restated ESPP"), to increase the number of shares of Company common stock (each, a "Share," and collectively, the "Shares") available for sale under the Restated ESPP by 3,000,000 Shares.

The existing version of our ESPP (the "Existing Plan") allows our employees to buy our Shares at a discount through their accumulated contributions. The Existing Plan is critical to our ability to compete for talent in the life sciences industry. As of May 1, 2020, 401,265 Shares remained available for sale under the Existing Plan. Our Board has determined that it is in the best interests of Fluidigm and its stockholders to amend and restate the Existing Plan to reserve an additional 3,000,000 Shares for sale under the Restated ESPP. The number of Shares purchased under the Existing Plan in each of fiscal 2017, 2018 and 2019, was 50,261, 251,884, and 296,590, respectively. Although our Board considered the historical Share purchases, the actual number of Shares that will be purchased under the Restated ESPP in any given future year will depend on a number of factors including, for example, the number of participants, each participant's contribution rate, and our stock price. Based on recent Share usage and projected participation numbers and contribution rates, our Board currently believes that these additional Shares will allow us to maintain the Restated ESPP for the next three years. The Existing Plan is a significant part of our overall equity compensation strategy (especially with respect to our non-executive employees). If our stockholders do not approve this Restated ESPP, we may not be able to offer competitive compensation to existing employees and qualified candidates, and our ability to recruit or retain talented employees may be impaired, which could adversely affect our business and long-term stockholder value.

Description of the Material Features of the Restated ESPP

The following paragraphs provide a summary of the material features of the Restated ESPP, and its operation. However, this summary is not a complete description of all of the provisions of the Restated ESPP and is qualified in its entirety by the specific language of the Restated ESPP. A copy of the Restated ESPP is provided as Exhibit I to this proxy statement.

Purpose

The purpose of the Restated ESPP is to provide eligible employees with an opportunity to purchase our Shares through accumulated contributions, which generally will be made through payroll deductions. The Restated ESPP permits the administrator (as discussed below) to grant purchase rights that qualify for preferential tax treatment under Section 423 of the Internal Revenue Code of 1986, as amended (the "Code"). In addition, the Restated ESPP authorizes the grant of purchase rights that do not qualify under Code Section 423 pursuant to rules, procedures or sub-plans adopted by the administrator that are designed to achieve desired tax or other objectives.

Shares Available for Issuance

The number of Shares initially reserved for issuance under the Existing Plan was 1,000,000 Shares. As a part of the Restated ESPP, we are requesting approval of an additional 3,000,000 Shares. If stockholders do not approve the Restated ESPP, then the Existing Plan will continue under its existing terms.

Administration

Our Board or a committee designated by our Board (also referred to as the administrator) will administer the Restated ESPP. All questions of interpretation or application of the Restated ESPP will be determined by the administrator and its decisions will be final and binding upon all participants. The administrator will have full and exclusive discretionary authority to construe, interpret, and apply the terms of the Restated ESPP, to designate separate offerings under the Restated ESPP, to adjudicate disputed claims under the Restated ESPP, and to establish such procedures that it deems necessary for the administration of the Restated ESPP. The administrator will be further authorized to adopt rules and procedures regarding eligibility to participate, the definition of "compensation," handling of contributions, and making of contributions to the Restated ESPP, among other responsibilities.

Eligibility

Generally, each employee of Fluidigm (or Fluidigm's designated subsidiaries) will be eligible to participate in the Restated ESPP, except that no employee will be eligible to participate in the Restated ESPP to the extent that (i) immediately after the grant, such employee would own 5% or more of the combined voting power of all classes of capital stock of Fluidigm or its parents or subsidiaries, or (ii) his or her rights to purchase stock under all of Fluidigm's employee stock purchase plans accrues at a rate that exceeds $25,000 worth of stock (determined as of the fair market value of the Shares on the beginning of the offering period) for each calendar year. In addition, the administrator, in its sole discretion and prior to an offering date, may determine that an individual will not be eligible to participate if he or she: (i) customarily works not more than 20 hours per week (or such lesser period of time as may be determined by the administrator in its discretion), (ii) is a highly compensated employee under Section 414(q) of the Code, or (iii) is a highly compensated employee under Section 414(q) of the Code with compensation above a certain level or is an officer or subject to the disclosure requirements of Section 16(a) of the Exchange Act. Non-employee directors will not be eligible to participate in the Restated ESPP.

As of May 1, 2020, approximately 390 employees of Fluidigm and its subsidiaries (including all of Fluidigm's executive officers in the United States and Canada) are eligible to participate in the Restated ESPP.

Offering Periods

Unless the administrator determines otherwise, each future offering period under the Restated ESPP will have a duration of approximately six months. The administrator, in its discretion, may modify the terms of offering periods before they begin.

Any employee that is an eligible employee on the first day of an offering period may participate in the offering period by timely submitting a properly completed subscription agreement or other procedure determined by the administrator. On the first day of each offering period, each participant automatically will be granted a right to purchase Shares. This purchase right will be exercised on the last trading day of each purchase period in the offering period to the extent of the contributions made during such purchase period, unless the purchase right has expired (upon termination of a participant's employment) or the participant has withdrawn from the Restated ESPP, as described in further detail below.

Contributions will be accumulated throughout each offering period, generally through payroll deductions. The Restated ESPP will permit participants to make payroll deductions of up to 10% of their eligible compensation, which includes base straight time gross earnings and payments for overtime and shift premium but excludes payments for incentive compensation, commissions, bonuses, and other similar compensation. During an offering period, a participant generally may not change the rate of payroll deductions during the offering period, but the participant may withdraw from the Restated ESPP and thereby discontinue his or her participation in the Restated ESPP.

Once an employee becomes a participant in the Restated ESPP, the employee automatically will participate in each successive offering period until the employee withdraws from the Restated ESPP or the employee's employment with Fluidigm or one of Fluidigm's designated subsidiaries terminates.

Exercise of Purchase Right

The number of whole Shares that a participant purchases in a purchase period will be determined by dividing the total amount of a participant's accumulated contributions during that offering period by the purchase price, except that no fractional Shares may be purchased under the Restated ESPP. Unless the administrator determines otherwise, the purchase price will be 85% of the lesser of the fair market value of our Shares on (i) the first day of the offering period or (ii) the last day of the purchase period, subject to compliance with the Code and the terms of the Restated ESPP. The fair market value of a Share on any relevant date generally will be the closing price of a Share on that date, as reported on Nasdaq. As of May 1, 2020, such per share closing price was $3.37.

A participant may not purchase more than 5,000 Shares in an offering period, and any contributions left over in a participant's account after his or her purchase right is exercised will be returned to the participant as soon as administratively possible after the end of each purchase period.

Withdrawal

Generally, a participant may withdraw all of his or her contributions from an offering period by submitting a written or electronic notice at least 10 days before the end of a purchase period, without such withdrawal affecting his or her eligibility to participate in future offering periods. However, once a participant withdraws from a particular offering period, that participant may not participate again in the same offering period. To participate in a subsequent offering period, the participant must deliver a new subscription agreement to Fluidigm.

Non-transferability

A participant may not assign, transfer, pledge, or otherwise dispose of in any way the contributions credited to his or her account or any right to purchase Shares under the Restated ESPP, except by will, the laws of descent and distribution, or by designation of a beneficiary in the manner provided under the Restated ESPP).

Termination of Employment

Upon termination of a participant's employment for any reason, including disability or death, he or she will be withdrawn from the Restated ESPP, the contributions credited to the participant's account (to the extent not used to purchase Shares under the Restated ESPP) will be returned to him or her (or, in the case of death, to the person or persons entitled to receive such contributions, as provided in the Restated ESPP), and such participant's right to purchase Shares under the Restated ESPP will automatically be terminated.

Adjustments upon Changes in Capitalization; Dissolution or Liquidation; Merger or Change in Control

Changes in Capitalization

If there is any dividend or other distribution (whether in the form of cash, common stock, other securities, or other property), recapitalization, stock split, reverse stock split, reorganization, merger, consolidation, split-up, spin-off, combination, repurchase, or exchange of Shares or other securities of Fluidigm, or other change in the corporate structure of Fluidigm affecting our Shares such that an adjustment is appropriate in order to prevent dilution or enlargement of the benefits or potential benefits intended to be made available under the Restated ESPP, then the administrator will adjust the number and class of Shares that may be delivered under the Restated ESPP, the purchase price per Share, the number of Shares covered by each right to purchase Shares under the Restated ESPP that has not yet been exercised, and the maximum number of Shares a participant can purchase during an offering period.

Dissolution or Liquidation

In the event of Fluidigm's proposed dissolution or liquidation, the administrator will shorten any offering period then in progress by setting a new purchase date and any offering periods will end on the new purchase date. The new purchase date will be prior to the dissolution or liquidation. If the administrator shortens any offering periods then in progress, the administrator will notify each participant in writing, at least ten business days prior to the new purchase date, that the purchase date has been changed to the new purchase date and that the right to purchase Shares under the Restated ESPP will be exercised automatically on the new purchase date, unless the participant has already withdrawn from the offering period.

Change in Control

If there is a merger or "change in control," as defined in the Restated ESPP, each right to purchase Shares under the Restated ESPP will be assumed or an equivalent right to purchase Shares will be substituted by the successor corporation or a parent or subsidiary of such successor corporation. If the successor corporation refuses to assume or substitute for the Restated ESPP purchase rights, the administrator will shorten the offering period covered by such Restated ESPP purchase right by setting a new purchase date on which such offering period will end. The new purchase date will be before the merger or change in control. If the administrator shortens any offering periods then in progress, the administrator will notify each participant in writing, before the new purchase date, that the purchase date has been changed to the new purchase date and that the right to purchase Shares under the Restated ESPP will be exercised automatically on the new purchase date, unless the participant has already withdrawn from the offering period.

Amendment and Termination of the Restated ESPP

The administrator may at any time amend, suspend, or terminate the Restated ESPP, including the term of any offering period or purchase period then outstanding. Generally, no such termination can adversely affect previously granted rights to purchase Shares under the Restated ESPP.

Upon its approval by the stockholders, the Restated ESPP will continue until terminated by the administrator in accordance with the terms of the Restated ESPP.

Certain Federal Income Tax Information

The following brief summary of the effect of the U.S. federal income taxation upon the participant and Fluidigm with respect to the Shares purchased under the Restated ESPP does not purport to be complete and does not discuss the tax consequences of a participant's death or the income tax laws of any state or foreign country in which the participant may reside.

The Restated ESPP, and the right of U.S. participants to make purchases thereunder, is intended to qualify under the provisions of Sections 421 and 423 of the Code. Under these provisions, no income will be taxable to a participant until the Shares purchased under the Restated ESPP are sold or otherwise disposed of. Upon sale or other disposition of the Shares, the participant will generally be subject to tax in an amount that depends upon the holding period. If the Shares are sold or otherwise disposed of more than two years from the first day of the applicable offering period and more than one year from the applicable date of purchase, the participant will recognize ordinary income measured as the lesser of (i) the excess of the fair market value of the Shares at the time of such sale or disposition over the purchase price or (ii) an amount equal to 15% of the fair market value of the Shares as of the first day of the applicable offering period. Any additional gain will be treated as long-term capital gain. If the Shares are sold or otherwise disposed of before the expiration of both of these holding periods, the participant will recognize ordinary income generally measured as the excess of the fair market value of the Shares on the date the Shares are purchased over the purchase price. Any additional gain or loss on such sale or disposition will be long-term or short-term capital gain or loss, depending on how long the Shares have been held from the date of purchase. Fluidigm generally is not entitled to a deduction for amounts taxed as ordinary income or capital gain to a participant except to the extent of ordinary income recognized by participants upon a sale or disposition of Shares before the expiration of the holding periods described above.

THE FOREGOING IS ONLY A SUMMARY OF THE EFFECT OF THE U.S. FEDERAL INCOME TAXATION UPON PARTICIPANTS AND FLUIDIGM UNDER THE RESTATED ESPP. IT DOES NOT PURPORT TO BE COMPLETE AND DOES NOT DISCUSS THE TAX CONSEQUENCES OF A PARTICIPANT'S DEATH OR THE PROVISIONS OF THE INCOME TAX LAWS OF ANY MUNICIPALITY, STATE, OR FOREIGN COUNTRY IN WHICH THE PARTICIPANT MAY RESIDE.

ESPP Benefits

Participation in the Restated ESPP will be voluntary and is dependent on each eligible employee's election to participate and his or her determination as to the level of contributions. Accordingly, future purchases under the Restated ESPP are not determinable.

For each of (i) our named executive officers, (ii) current executive officers, as a group, and (iii) all employees who are not executive officers, as a group, the following table sets forth the number of Shares purchased under the Existing Plan during fiscal 2019 and the weighted average per Share purchase price for such Shares.

	Number of Purchased Shares	Weighted Average Per Share Purchase Price
Named Executive Officers		
Stephen Christopher Linthwaite *President and Chief Executive Officer*	3,461	$6.783
Vikram Jog *Chief Financial Officer*	—	N.A.
Colin McCracken *Chief Commercial Officer*	—	N.A.
Bradley Kreger *Senior Vice President, Global Operations*	—	N.A.
Nicholas Khadder *Senior Vice President, General Counsel, and Secretary*	2,632	$3.496
Executive officers as a group	18,960	$4.689
All employees (excluding executive officers)	277,630	$3.549

Required Vote

The affirmative "FOR" vote of a majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the proposal is required to approve the Restated ESPP. You may vote "FOR," "AGAINST," or "ABSTAIN" on this proposal. Abstentions have the same effect as a vote against the proposal. Broker non-votes are not included in the tabulation of voting results on this proposal, and will not affect the outcome of voting on this proposal.

Recommendation

Our Board recommends a vote "FOR" the approval of the Restated ESPP.

PROPOSAL NUMBER 4

APPROVAL OF AMENDMENT OF THE 2011 EQUITY INCENTIVE PLAN TO INCREASE THE NUMBER OF SHARES RESERVED FOR ISSUANCE THEREUNDER BY 1,420,000 SHARES

We are asking our stockholders to approve an amendment to our 2011 Equity Incentive Plan (the "2011 Plan") to increase the number of shares reserved for issuance under the 2011 Plan by 1,420,000 shares. Other than increasing the 2011 Plan by these additional 1,420,000 shares, no material changes will be made to our 2011 Plan. Our Board approved the amendment in May 2020, subject to the approval of our stockholders at the Annual Meeting. If the amendment is not approved by our stockholders, the 2011 Plan will continue by its terms, without the share increase, and will terminate automatically in April 2029.

Before the amendment, the aggregate number of shares of our common stock reserved for issuance under the 2011 Plan during its entire term was 13,068,924, plus any shares forfeited under pre-existing equity incentive plans after the effectiveness of the 2011 Plan. As of May 1, 2020, 6,022,849 shares of our common stock are subject to outstanding awards granted under the 2011 Plan and 3,583,102 shares of our common stock remain available for issuance (which does not take into account anticipated retention grants as discussed in further detail below or any shares that may be subsequently added to the 2011 Plan through future forfeitures).

In connection with our 2019 annual meeting of stockholders, our stockholders approved an increase of 4,950,644 shares in the aggregate number of shares of common stock available for issuance under the 2011 Plan, which we believed at the time to be sufficient to cover our budgeted equity compensation requirements through the 2021 annual meeting of stockholders. On June 3, 2019, the date of our 2019 annual meeting of stockholders, the closing price of our common stock in trading on Nasdaq was $13.41, and on May 13, 2020, the date immediately before the filing date of this proxy statement, the closing price of our common stock was $4.89. Events subsequent to our 2019 annual meeting of stockholders—including in particular the global crisis unleashed by the COVID-19 pandemic—have focused the deliberations of our Compensation Committee and Board on, among other things, maintaining our financial condition through an uncertain business climate. As a result, our Compensation Committee recommended and our Board approved a 1,420,000 share increase for the following principle reasons:

- In order to maintain our liquidity position until we have better visibility concerning the impact of COVID-19 on our revenues, we have temporarily reduced base salaries for our executive officers and upper level employees by 20% (with temporary salary reductions of 10% at all other levels). In order to retain key employees, our Compensation Committee has accordingly increased the weighting of equity compensation relative to total direct compensation. We continue to offer annual short-term cash incentives under our Executive Bonus Plan and employee bonus programs, but those plans are intended to be largely self-funding and will therefore depend substantially on our revenues and financial condition.

- Our Board and Compensation Committee believe we could face material key employee retention risks if we are unable to provide long-term retention incentives. As part of its analysis of retention risks, our Compensation Committee evaluated the vested versus unvested value of currently outstanding equity incentive awards for our key management personnel and believes that the value of those unvested awards, even at higher prices than our current trading price, provides an insufficient financial incentive to ensure either short or long-term retention.

- The value of the awards that we have granted and would be able to grant absent additional share reserves places us at a competitive disadvantage relative to the companies with which we compete for employees. Even before the COVID-19 outbreak reached North America in early 2020, as a result of declines in our stock price over the last year, share reserve limitations constrained our Compensation Committee's ability to make 2020 focal awards with a grant value that it considered to be competitive within our markets. Our principle management, scientific, and engineering personnel are based in either the San Francisco Bay Area or Toronto. Compensation levels in each of these markets remain relatively high and, particularly in the Bay Area, we must compete for talent with some of the largest companies in the world.

- Our Compensation Committee has not yet finalized the terms of its equity retention program but expects the program to use substantially all of our currently available equity reserves, thus necessitating our request for additional shares. As of the date of this proxy statement, final determinations have not been made with respect to the allocation of awards under the equity retention program, but we expect to make awards of restricted stock units to all our executive officers and to key management and critically skilled employees. In order to incentivize retention through the next year, which we believe is critical to manage current uncertainty, vesting of the retention awards will be as follows: 50% of the retention awards will vest on the first anniversary of the date of grant, and the remaining shares subject to the awards will vest in two installments of 25% of the total award on the second and third anniversaries of the date of grant.

- Our Board and Compensation Committee believe this program is appropriate and necessary, and in the best interests of our stockholders, in order to provide retention incentives and align management interests with our objective to exit the COVID-19 crisis successfully.

- After giving effect to grants intended to be made under our equity retention program, we believe the proposed share increase under the 2011 Plan will be sufficient to address our expected requirements through at least the 2021 annual meeting of stockholders. As a governance matter, our Board and Compensation Committee determined that it was appropriate to limit our request to a number sufficient for only the next year, given our current focus on weathering the COVID-19 crisis over the next 12 months and, assuming our current usage projections prove correct, to permit stockholders another opportunity to vote on any additional increases in 2021.

In determining and recommending the increase to the share reserve under the 2011 Plan, our Board considered, in addition to the factors cited above, a number of factors, including dilutive impact, burn rate, and plan duration.

Historical Grant Practices. Our Board considered the historical numbers of stock options, RSUs, performance-based stock options, and performance-based RSUs that we have granted in the past three years. The annual share usage, or burn rate, under our equity compensation program for the last three years was as follows:

Annual Share Usage	2017	2018	2019	Three-Year Average
Stock options granted	1,363,460(1)	757,770	49,500	723,577
Non-performance RSUs granted	915,883(2)	1,821,885	1,803,862	1,513,877
Non-performance RSUs vested	445,355	945,119	726,239	705,571
Performance-based stock options granted	—	—	—	—
Performance-based RSUs granted	—	167,000	468,826	211,942
Performance-based RSUs vested	—	—	3,957	1,319
Total equity awards granted(3)	2,279,343	2,746,655	2,322,188	2,449,395
Basic weighted average shares of common stock outstanding as of December 31	32,980,163	39,651,703	66,778,649	46,470,172
Annual share usage	155,315(4)	1,862,614	1,761,083	1,259,004

(1) 379,443 of the stock options granted in 2017 were awarded solely pursuant to our stock option exchange program.
(2) 54,944 of the RSUs granted in 2017 were awarded solely pursuant to our stock option exchange program.
(3) Represents stock options, performance-based stock options, RSUs, and performance-based RSUs.
(4) Adjusted to exclude the effect of the 2017 stock option exchange program.

Forecasted Grant Practices. Based on our historical grant practices and after giving effect to the special retention grants described above, we currently forecast granting equity awards covering approximately 4,270,000 shares over the next 12-month period, which is equal to approximately 5.3% of the fully diluted number of shares of our common stock outstanding as of May 1, 2020. In light of this forecast, we believe, and our Board considered, that the requested increase to the 2011 Plan's share reserve will provide a sufficient number of shares to allow us to grant equity awards for the purpose of our expected new hires, focal awards, any special retention needs, and employee growth through any opportunistic acquisitions or hiring for approximately one year. However, circumstances could alter this projection, such as a change in business conditions, our stock price, competitive pressures for attracting and retaining employees, or our company strategy.

Awards Outstanding Under Existing Grants and Dilutive Impact. As of May 1, 2020, we have outstanding equity awards under the 2011 Plan, the 2017 Inducement Award Plan ("Inducement Plan"), and prior plans covering approximately 6,578,709 shares. These outstanding equity awards (commonly referred to as the "overhang"), together with the 3,583,102 shares currently available for grant under the 2011 Plan, represent approximately 12.6% of the fully diluted number of shares of our common stock. The dilutive impact of the additional 1,420,000 shares that would be available for issuance under the 2011 Plan would increase the overhang percentage by approximately 1.5 percentage points to approximately 14.1%, each based on our fully diluted number of shares of our common stock as of May 1, 2020 (in all cases without consideration of shares potentially issuable upon conversion of outstanding convertible indebtedness).

If the stockholders do not approve the amendment to the 2011 Plan, the 2011 Plan will continue without the amendment. In that case, the shares reserved for issuance under the 2011 Plan may be insufficient to achieve our future incentive, recruiting, and retention objectives. Consequently, without stockholder approval of the amendment to our 2011 Plan, we believe our ability to attract and retain the individuals necessary to drive our performance and increase long-term stockholder value will be impaired. We therefore believe that stockholder approval of the amendment to our 2011 Plan is important to our continued success.

Our executive officers and directors have an interest in the approval of the amendment to the 2011 Plan by our stockholders because they would be eligible to receive awards under the 2011 Plan. Our Board and Compensation Committee have approved the amendment to the 2011 Plan, subject to the approval of our stockholders at the Annual Meeting.

Summary of the 2011 Plan

The amendment to our 2011 Plan was approved by our Board in May 2020. The following general description of the material features of the 2011 Plan, as amended, is qualified in its entirety by reference to the provisions of the 2011 Plan set forth in Exhibit II to this proxy statement.

Eligibility. Our 2011 Plan provides for the grant of incentive stock options, within the meaning of Section 422 of the Internal Revenue Code of 1986, as amended, to our employees and the employees of our subsidiaries, and for the grant of nonstatutory stock options, restricted stock, restricted stock units, stock appreciation rights, performance units and performance shares to our employees, directors and consultants and the employees and consultants of our subsidiaries. As of May 1, 2020, we had seven non-employee directors, approximately 70 consultants, and approximately 600 employees (including our employee director).

Shares Available for Grant and Shares Outstanding. The total number of shares of our common stock available for issuance under our 2011 Plan is equal to 5,003,102 shares (assuming the shares available for grant as of May 1, 2020 remain available upon the Annual Meeting). As of May 1, 2020, 6,022,849 shares of our common stock are subject to outstanding awards grant under the 2011 Plan. As described in the paragraph below, outstanding awards under the 2011 Plan that expire or forfeit return to the pool to be available for grant.

Generally, if an option award expires or becomes unexercisable without having been exercised in full, or if restricted stock, performance shares, or shares subject to restricted stock units or performance units are forfeited or repurchased by us due to failure to vest, the unpurchased, forfeited, or repurchased shares that were subject to such awards will become available for future grant or sale under the 2011 Plan (unless it has terminated). With respect to stock appreciation rights, only shares actually issued will cease to be available. Shares used to pay the exercise price of an award or to satisfy the tax withholding obligations related to an award will become available for future grant or sale. To the extent an award is paid out in cash rather than shares, such cash payment will not reduce the number of shares available for issuance.

Administration. Our 2011 Plan is administered by our Board or a committee appointed by our Board. Currently, our Compensation Committee administers our 2011 Plan. Different committees may administer our 2011 Plan with respect to different groups of service providers. To make grants to certain officers and key employees, the members of the committee must qualify as "non-employee directors" under Rule 16b-3 of the Exchange Act.

Subject to the provisions of our 2011 Plan, the administrator generally has the power to make all determinations deemed necessary or advisable for administering the 2011 Plan. The administrator has the power to determine the terms of awards, including the exercise price (if any), the number of shares subject to each such award, the time when awards may vest or be exercised (including the ability to accelerate the vesting and exercisability of awards), and the form of consideration payable upon exercise, if applicable. The administrator also has the authority to amend awards. The administrator may not implement any exchange program under which (i) outstanding awards are surrendered or canceled in exchange for awards of the same type (which may have higher or lower exercise prices and different terms), awards of a different type, and/or cash, (ii) participants have the opportunity to transfer any outstanding awards to a financial institution or other person or entity selected by the administrator, and/or (iii) the exercise price of an outstanding award is increased or reduced. In addition, the administrator may provide for dividends or dividend equivalents to accrue on unvested awards, but no dividends or dividend equivalents will be paid until the vesting of such awards. The administrator's decisions, determinations, and interpretations are final and binding on all participants and any other holders of awards.

Stock Options. Options may be granted under our 2011 Plan. Subject to the provisions of our 2011 Plan, the administrator determines the terms and conditions of options, including when such options vest and become exercisable (and the administrator has the discretion to accelerate the time at which such options will vest or become exercisable). The per share exercise price of any option generally must be at least 100% of the fair market value of a share of our common stock on the date of grant, and the term of an incentive stock option may not be more than 10 years. However, with respect to any incentive stock option granted to an individual who owns 10% of the voting power of all classes of stock of our company or any of its parent or subsidiary corporations, the term of such option must not exceed 5 years, and the per share exercise price of such incentive stock option must be at least 110% of the fair market value of a share of our common stock on the grant date. After a participant's service terminates, he or she generally may exercise the vested portion of his or her option for the period of time stated in his or her option agreement. Generally, if termination is due to death or disability, the option will remain exercisable for 12 months. In all other cases, the option will generally remain exercisable for 3 months following the termination of service. However, in no event may an option be exercised later than the expiration of its term.

Stock Appreciation Rights. Stock appreciation rights may be granted under our 2011 Plan. Stock appreciation rights allow the recipient to receive the appreciation in the fair market value of our common stock between the exercise date and the date of grant. Subject to the provisions of our 2011 Plan, the administrator determines the terms and conditions of stock appreciation rights, including when such rights vest and become exercisable (and the administrator has the discretion to accelerate the time at which such rights will vest or become exercisable) and whether to pay any increased appreciation in cash, shares of our common stock, or a combination of both. The per share exercise price of a stock appreciation right must be at least 100% of the fair market value per share on the date of grant, and the term of a stock appreciation right may not be more than 10 years. After a participant's service terminates, he or she generally may exercise the vested portion of his or her stock appreciation right for the period of time stated in his or her option agreement. However, in no event may a stock appreciation right be exercised later than the expiration of its term.

Restricted Stock. Restricted stock may be granted under our 2011 Plan. Restricted stock awards are grants of shares of our common stock that vest in accordance with terms and conditions established by the administrator. The administrator will determine the number of shares of restricted stock granted to any employee, director or consultant. The administrator may impose whatever conditions to vesting it determines to be appropriate (for example, the administrator may set restrictions based on the achievement of specific performance goals or continued service to us), and the administrator has the discretion to accelerate the time at which any restrictions will lapse or be removed. Shares of restricted stock that do not vest are subject to our right of repurchase or forfeiture.

Restricted Stock Units. Restricted stock units may be granted under our 2011 Plan. Restricted stock units are bookkeeping entries representing an amount equal to the fair market value of one share of our common stock. The administrator determines the terms and conditions of restricted stock units including the vesting criteria (which may include accomplishing specified performance criteria or continued service to us) and the form and timing of payment. The administrator has the discretion to accelerate the time at which any restrictions will lapse or be removed.

Performance Units and Shares. Performance units and performance shares may be granted under our 2011 Plan. Performance units and performance shares are awards that will result in a payment to a participant only if performance objectives established by the administrator are achieved or the awards otherwise vest. The administrator will establish organizational or individual performance objectives in its discretion, which, depending on the extent to which they are met, will determine the number and/or the value of performance units and performance shares to be paid out to participants. The administrator has the discretion to reduce or waive any performance objectives or other vesting provisions for performance units or performance shares. Performance units will have an initial dollar value established by the administrator on or before to the grant date. Performance shares will have an initial value equal to the fair market value of our common stock on the grant date. The administrator has the discretion to pay earned performance units or performance shares in the form of cash, shares, or in some combination of both.

Transferability of Awards. Our 2011 Plan does not allow for the transfer of awards unless the administrator provides otherwise, and in no event may an award be transferred for value or consideration. Additionally, only the recipient of an award may exercise an award during his or her lifetime.

Outside Directors. Our 2011 Plan provides that any outside (non-employee) director, in any fiscal year, may not be granted equity awards under our 2011 Plan with an aggregate grant date fair value of more than $400,000, or $500,000 with respect to his or her first year of service as an outside director. For purposes of this limitation, the grant date fair value is determined in accordance with U.S. generally accepted accounting principles (GAAP). Any equity awards granted under our 2011 Plan to an outside director for his or her services as an employee, or for his or her services as a consultant (other than as a non-employee director), will not count for purposes of the limitation. The maximum limit does not reflect the intended size of any potential compensation or equity awards to our outside (non-employee) directors. The outside (non-employee) director annual limits were developed with input from Meridian Compensation Partners, LLC, an independent compensation consulting firm, based on a review of non-employee director limits in equity plans for comparable companies.

Certain Adjustments. If there are certain changes in our capitalization, the administrator will adjust the number and class of shares that may be delivered under the 2011 Plan; the number, class, and price of shares covered by each outstanding award; and the numerical share limits contained in the 2011 Plan.

Dissolution or Liquidation. If there is a proposed liquidation or dissolution of our company, the administrator will notify participants as soon as practicable before the effective date of such event and all awards, to the extent that they have not been previously exercised, will terminate immediately before the consummation of such event.

Merger or Change in Control. Our 2011 Plan provides that if there is a merger of the company with or into another company or a "change in control" (as defined under the 2011 Plan) of our company, each outstanding award will be treated as provided in the applicable award agreement or as described below. The administrator is not required to treat all awards similarly. If the successor corporation does not assume or substitute an equivalent award for any outstanding award, then such award will fully vest, all restrictions on such award will lapse, all performance goals or other vesting criteria applicable to such award will be deemed achieved at 100% of target levels, and the administrator will notify participants that awards will become fully exercisable, if applicable, for a specified period before the transaction. The award will then terminate upon the expiration of the specified period of time.

With respect to awards held by a non-employee director that are assumed or substituted for, if such non-employee director's service as our director or that of a successor corporation is terminated on or after the date of such merger or change in control (except for a voluntary resignation that is not at the request of the acquirer), then the non-employee director will fully vest in and have the right to exercise his or her options and/or stock appreciation rights, all restrictions on his or her restricted stock and restricted stock units will lapse, and, with respect to performance units and performance shares, all performance goals or other vesting criteria will be deemed achieved at 100% of target levels and all other terms and conditions met in the event.

Forfeiture and Clawback. All awards granted under our 2011 Plan will be subject to recoupment under our current clawback policy and any clawback policy that we are required to adopt under applicable law. In addition, the administrator may provide in an award agreement that the recipient's rights, payments, and benefits with respect to such award shall be subject to reduction, cancellation, forfeiture, or recoupment upon the occurrence of specified events.

Plan Amendments and Termination. Our 2011 Plan will automatically terminate in 2029, unless we terminate it sooner. In addition, our Board has the authority to amend, suspend, or terminate the 2011 Plan, but such action will not impair the rights of any participant without his or her written consent.

New Plan Benefits

As noted above, our Compensation Committee expects to make substantial retention grants under the 2011 Plan to our executive officers and key management, engineering, scientific, and other critically skilled personnel. As of the date of this proxy statement, our Compensation Committee has not approved any such awards or determined any allocation of these awards among eligible employees.

The number of awards that an employee, director, or consultant may receive under the 2011 Plan is in the discretion of the administrator and therefore cannot be determined in advance. For (i) each of our named executive officers, (ii) our executive officers, as a group, (iii) our directors who are not executive officers, as a group, and (iv) all of our employees who are not executive officers, as a group, the following table sets forth the following information:

(A) the aggregate number of shares subject to stock options granted under the 2011 Plan during 2019;
(B) the average per share exercise price of such options;
(C) the aggregate number of RSUs (including performance-based RSUs) granted under the 2011 Plan and the Inducement Plan during 2019; and
(D) the dollar value of such RSUs.

	Shares Subject to Stock Options	Average Per Share Exercise Price of Options	Shares Subject to Restricted Stock Units	Dollar Value of Restricted Stock Units(1)
Named Executive Officers				
Stephen Christopher Linthwaite *President and Chief Executive Officer*	—	—	224,719	$757,303
Vikram Jog *Chief Financial Officer*	—	—	73,034	$246,125
Colin McCracken *Chief Commercial Officer*	—	—	101,955	$343,588
Bradley Kreger *Senior Vice President, Global Operations*	—	—	73,034	$246,125
Nicholas Khadder *Senior Vice President, General Counsel, and Secretary*	—	—	67,416	$227,192
Executive officers as a group	—	—	946,394	$3,189,348
Non-employee directors	49,500	$13.08	42,855	$144,421
All employees (excluding executive officers)	—	—	1,283,439	$4,325,189

(1) Reflects the aggregate fair value of the equity awards computed in accordance with ASC 718, based on the $3.37 closing price per share of our common stock on Nasdaq on May 1, 2020.

Required Vote

The affirmative "FOR" vote of a majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the proposal is required to approve the amendment to the 2011 Plan to increase the number of shares reserved for issuance under the 2011 Plan by 1,420,000 shares. You may vote "FOR," "AGAINST," or "ABSTAIN" on this proposal.

Abstentions have the same effect as a vote against the proposal. Broker non-votes are not included in the tabulation of voting results on this proposal, and will not affect the outcome of voting on this proposal.

Recommendation

Our Board recommends a vote "FOR" the approval of the amendment to the 2011 Plan to increase the number of shares reserved for issuance under the 2011 Plan by 1,420,000 shares.

PROPOSAL NUMBER 5

RATIFICATION OF APPOINTMENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Our Audit Committee has appointed PricewaterhouseCoopers LLP to audit the financial statements of our company for the fiscal year ending December 31, 2020 and recommends that stockholders vote in favor of the ratification of such appointment. During 2019, PricewaterhouseCoopers LLP served as our registered independent public accounting firm.

At the Annual Meeting, stockholders are being asked to ratify the appointment of PricewaterhouseCoopers LLP as our independent registered public accounting firm for our fiscal year ending December 31, 2020. Stockholder ratification of the appointment of PricewaterhouseCoopers LLP is not required by our bylaws or other applicable legal requirements. However, our Board is submitting the appointment of PricewaterhouseCoopers LLP to our stockholders for ratification as a matter of good corporate governance. In the event that this appointment is not ratified by the affirmative vote of a majority of the shares of common stock present in person or represented by proxy at the Annual Meeting and entitled to vote, such appointment will be reconsidered by our Audit Committee. Even if the appointment is ratified, our Audit Committee, in its sole discretion, may appoint another independent registered public accounting firm at any time during our fiscal year ending December 31, 2020 if our Audit Committee believes that such a change would be in the best interests of Fluidigm and its stockholders. A representative of PricewaterhouseCoopers LLP is expected to be present at the Annual Meeting, will have an opportunity to make a statement if he or she wishes to do so, and is expected to be available to respond to appropriate questions from stockholders.

Required Vote

Ratification of the appointment of PricewaterhouseCoopers LLP as our independent registered public accounting firm for the year ending December 31, 2020 requires the affirmative "FOR" vote of a majority of the voting power of the shares present in person or represented by proxy at the meeting and entitled to vote on the proposal. You may vote "FOR," "AGAINST," or "ABSTAIN" on this proposal. Abstentions are deemed to be votes cast and have the same effect as a vote against the proposal. Broker non-votes are not deemed to be votes cast, are not included in the tabulation of voting results on this proposal, and will not affect the outcome of voting on this proposal.

Recommendation

Our Board recommends a vote "FOR" the ratification of the appointment of PricewaterhouseCoopers LLP as our independent registered public accounting firm for the year ending December 31, 2020.

Principal Accounting Fees and Services

The following table sets forth the aggregate fees for audit services provided by PricewaterhouseCoopers LLP for the years ended December 31, 2019 and December 31, 2018:

	2019	2018
Audit fees[(1)]	$1,763,821	$1,643,990
Audit-related fees[(2)]	331,229	—
Tax fees[(3)]	140,000	—
All other fees[(4)]	4,500	3,600
Total fees	$2,239,550	$1,647,590

(1) Audit fees for 2019 consist of fees billed or to be billed by PricewaterhouseCoopers LLP for professional services rendered for the integrated audit of our annual consolidated financial statements and management's report on internal controls included in our Annual Report on Form 10-K; for the review of the consolidated financial statements included in our quarterly reports on Form 10-Q; and for other services, including statutory audits and services rendered in connection with SEC filings. We note that for year 2018, $132,355 of the fees were reclassified from audit-related fees to audit fees to conform to the current year's presentation.

(2) Audit-related fees consist of fees for assurance and related services that are reasonably related to the performance of the audit or review of our financial statements and are not reported under "Audit Fees." These services include consultations concerning financial accounting and reporting standards.

(3) Tax fees consist of fees billed by PricewaterhouseCoopers LLP for professional services rendered for tax compliance, consultation and planning services.

(4) All other fees consist of fees billed by PricewaterhouseCoopers LLP for professional services other than the services reported above. These fees primarily consist of fees attributable to permissible consulting services as well as fees to license specialized accounting research software.

Policy on Audit Committee Pre-Approval of Services Performed by Independent Registered Public Accounting Firm

Consistent with the requirements of the SEC and the Public Company Accounting Oversight Board (PCAOB) regarding auditor independence, our Audit Committee has responsibility for appointing, setting compensation, and overseeing the work of our independent registered public accounting firm. In recognition of this responsibility, our Audit Committee has established a policy for the pre-approval of all audit and permissible non-audit services provided by the independent registered public accounting firm. These services may include audit services, audit-related services, tax services, and other services. The Audit Committee generally pre-approves particular services or categories of services on a case-by-case basis. The independent registered public accounting firm and management are required to periodically report to the Audit Committee regarding the extent of services provided by the independent registered public accounting firm in accordance with these pre-approvals, and the fees for the services performed to date.

All of the services of PricewaterhouseCoopers LLP for 2018 and 2019 described above were pre-approved by the Audit Committee.

Report of the Audit Committee

The Audit Committee assists the Board in fulfilling its oversight responsibility over Fluidigm's financial reporting process. It is not the duty of the Audit Committee to plan or conduct audits, to prepare Fluidigm's financial statements, or to assess Fluidigm's internal control over financial reporting. Management has the primary responsibility for preparing the financial statements and assuring their accuracy, effectiveness, and completeness. Management is also responsible for the reporting process, including the system of internal controls. The independent registered public accounting firm is responsible for auditing Fluidigm's financial statements and internal control over financial reporting and expressing its opinion as to whether the statements present fairly, in accordance with accounting principles generally accepted in the United States, Fluidigm's financial condition, results of operations, and cash flows. However, the Audit Committee reviews and discusses the financial statements with management and the independent registered public accounting firm prior to the presentation of financial statements to our stockholders and, as appropriate, initiates inquiries into various aspects of Fluidigm's financial affairs.

Unless the Audit Committee has reason to question its reliance on management or the independent registered public accounting firm, the members of the Audit Committee necessarily rely on information provided to them by and on the representations made by management and the independent registered public accounting firm. Accordingly, the Audit Committee's oversight does not provide an independent basis to determine that management has applied appropriate accounting and financial reporting principles. Furthermore, the Audit Committee's authority and oversight responsibilities do not independently assure that the audits of Fluidigm's financial statements have been carried out in accordance with the standards of the PCAOB or that the financial statements are presented in accordance with accounting principles generally accepted in the United States.

In this context, the Audit Committee has met and held discussions with management and the independent registered public accounting firm to review Fluidigm's audited 2019 consolidated financial statements (including the quality of Fluidigm's accounting principles). Management represented to the Audit Committee that Fluidigm's consolidated financial statements were prepared in accordance with accounting principles generally accepted in the United States, and the Audit Committee consulted with management and the independent registered public accounting firm prior to approving the presentation of the audited 2019 consolidated financial statements to stockholders. The Audit Committee discussed with the independent registered public accounting firm the matters required to be discussed by Statement on Auditing Standards No. 1301, *Communications with Audit Committees*, as adopted by the PCAOB.

The Audit Committee has discussed with the independent accountant the independent accountant's independence from Fluidigm and its management. As part of that review, the Audit Committee received the written disclosures and letter required by the applicable requirements of the PCAOB regarding the independent accountant's communications with the Audit Committee concerning independence. Based on the reviews and discussions referred to above, the Audit Committee recommended to the Board, and the Board approved, Fluidigm's audited consolidated financial statements for the year ended December 31, 2019 for filing with the SEC as part of Fluidigm's Annual Report on Form 10-K. The Audit Committee has appointed PricewaterhouseCoopers LLP as the company's independent registered public accounting firm for the year ending December 31, 2020.

The Audit Committee

Patrick S. Jones (Chair)
Gerhard F. Burbach
Laura M. Clague
Bill W. Colston

The Audit Committee Report does not constitute soliciting material, and shall not be deemed to be filed or incorporated by reference into any other filing by Fluidigm under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, except to the extent Fluidigm specifically incorporates the Audit Committee Report by reference therein.

EXECUTIVE OFFICERS

The names of our executive officers, their ages, their positions with Fluidigm and other biographical information as of May 5, 2020 are set forth below. There are no family relationships among any of our directors or executive officers.

Name	Age	Position
Stephen Christopher Linthwaite	48	President, CEO, and Director
Vikram Jog	64	Chief Financial Officer
Colin McCracken	47	Chief Commercial Officer
Bradley Kreger	45	Senior Vice President, Global Operations
Nicholas Khadder(1)	47	Senior Vice President, General Counsel, and Secretary

(1) Mr. Khadder rejoined the Company effective April 27, 2020, and was reelected as an executive officer of the Company effective May 5, 2020.

Stephen Christopher Linthwaite. Please see the biographical information provided above in the section entitled "*Continuing Class III Directors (Term Expiring in 2022)*."

Vikram Jog has served as our Chief Financial Officer since February 2008. From April 2005 to February 2008, Mr. Jog served as chief financial officer for XDx, Inc. (now CareDx, Inc.), a molecular diagnostics company. From March 2003 to April 2005, Mr. Jog was a vice president of Applera Corporation, a life science company that is now part of Thermo Fisher Scientific, and vice president of finance for its related businesses Celera Genomics and Celera Diagnostics. From April 2001 to March 2003, Mr. Jog was vice president of finance for Celera Diagnostics and corporate controller of Applera Corporation. Mr. Jog received a Bachelor of Commerce degree from Delhi University and an M.B.A. from Temple University. Mr. Jog is a member of the American Institute of Certified Public Accountants.

Colin McCracken joined Fluidigm as Chief Commercial Officer in March 2019. From 2015 to 2019, Mr. McCracken held various positions at Thermo Fisher Scientific, a life sciences company, including vice president, sales, chromatography and mass spectrometry, from 2017 to 2019, and vice president and general manager, Middle East, Africa and Eastern Europe from 2015 to 2017. Prior to Thermo Fisher, Mr. McCracken served as vice president and head of European sales at Life Technologies, a life sciences company, from 2009 to 2013, and as vice president and head of European sales at Invitrogen Corporation, a predecessor of Life Technologies, from 2008 to 2009. Prior to Invitrogen, Mr. McCracken served as national sales manager at QiAGEN, a biotechnology company, from 2002 to 2005. Mr. McCracken received an honors degree in electrical and electronic engineering from the University of Strathclyde in Glasgow.

Bradley Kreger joined Fluidigm as Senior Vice President, Global Operations in April 2018. From December 2016 to April 2018, Mr. Kreger was senior director, operations, clinical sequencing division at Thermo Fisher Scientific, a life sciences company. From 1995 to December 2016, Mr. Kreger held various staff and management positions at Affymetrix, a biotechnology company, including vice president, reagent manufacturing and global process engineering, senior director, global process engineering and manufacturing science, and director, global process engineering and manufacturing science. Mr. Kreger received an M.B.A. from Western Governors University and a B.S. in Biotechnology and Business from Charter Oak State College.

Nicholas Khadder has served as our Senior Vice President, General Counsel, and Corporate Secretary, most recently since May 2020, and, previously, from June 2016 to March 2020. From 2010 to June 2016, Mr. Khadder held various positions at Amyris, Inc., an industrial biotechnology company, including senior vice president, general counsel and corporate secretary from 2013 to June 2016, interim general counsel from July 2013 to December 2013 and assistant general counsel from October 2010 to July 2013. Prior to joining Amyris, Mr. Khadder served in senior corporate counsel roles at LeapFrog Enterprises, Inc., an educational entertainment company, from August 2008 to September 2010, and at Protiviti, Inc., an internal audit and risk consulting firm, from June 2005 to July 2008. Before commencing his in-house legal career, Mr. Khadder was a corporate law associate at Fenwick & West LLP from 1998 to 2005. Mr. Khadder received a J.D. from Berkeley Law (the University of California, Berkeley, School of Law) and a B.A. in English from the University of California, Berkeley.

COMPENSATION DISCUSSION AND ANALYSIS

The following discussion and analysis of compensation arrangements of our named executive officers should be read together with the compensation tables and related disclosures set forth below.

Introduction

In this Compensation Discussion and Analysis, we provide the following:

Named Executive Officers

This Compensation Discussion and Analysis describes the material elements of compensation awarded to, earned by, or paid to our executive officers, including our named executive officers (“NEOs”), during 2019. Our NEOs for 2019 were:

Stephen Christopher Linthwaite	President and CEO
Vikram Jog	Chief Financial Officer
Colin McCracken	Chief Commercial Officer
Bradley Kreger	Senior Vice President, Global Operations
Nicholas Khadder[(1)].	Senior Vice President, General Counsel, and Secretary

(1) As previously disclosed in our Annual Report on Form 10-K for the fiscal year ended December 31, 2019, as filed with the SEC on February 27, 2020 (the “Form 10-K”), Mr. Khadder resigned from the Company effective March 13, 2020. Mr. Khadder subsequently rejoined the Company effective April 27, 2020.

Executive Summary

Company Overview

Fluidigm is an industry-leading biotechnology tools provider with a vision to improve life through comprehensive health insight. We focus on the most pressing needs in translational and clinical research, including cancer, immunology, and immunotherapy. Using proprietary CyTOF® and microfluidics technologies, we develop, manufacture, and market multi-omic solutions to drive meaningful insights in health and disease, identify biomarkers to inform decisions, and accelerate the development of more effective therapies. Our customers are leading academic, government, pharmaceutical, biotechnology, contract research organizations, and plant and animal research laboratories worldwide. Together with them, we strive to increase the quality of life for all.

2019 Business and Performance Highlights

- Continued revenue growth: Annual revenue of $117.2 million from $113.0 million in 2018, with mass cytometry revenue growth of 23%, compared to 2018
- Launch of over 10 new products for our mass cytometry business, as well as new microfluidics content to drive penetration of new key accounts
- Strengthened balance sheet and liquidity:
  - March 2019 retirement of the Company’s 2018 2.75% convertible notes due 2034 with an aggregate principal value of $150 million

- ◦ November 2019 private placement of $55.0 million in aggregate principal amount of 5.25% convertible notes due 2024 and concurrent retirement of $50.2 million in aggregate principal amount of the Company's 2014 2.75% convertible notes due 2034
- ◦ Maintained a $15 million revolving credit facility with Silicon Valley Bank
  - – In April 2020, the maturity date of such credit facility was extended to August 2022

Executive Compensation Highlights

In 2019 and early 2020, the Compensation Committee took the following actions to align executive compensation with Company performance and the short- and long-term interests of stockholders:

- Granted performance-based restricted stock unit awards ("PSUs") contingent upon total stockholder return over a three-year performance period relative to the companies in the Russell 3000 Index.
- Increased the weighting of PSUs to 51% of the annual equity grants—sometimes referred to as long-term incentive compensation ("LTI")—with the remaining 49% granted in time-based RSUs.
  - ◦ For 2020, increased the portion of LTI granted in PSUs from 51% to 55% to further demonstrate the long-term alignment of our executives' interests with those of our stockholders.
- Established the 2019 annual executive cash incentive program pursuant to our Executive Bonus Plan (the "2019 Cash Incentive Program"), which measured annual performance based on predefined financial goals with adjustments based on each executive's strategic goals and contributions.
- Approved payouts under the 2019 Cash Incentive Program of between 18.7% and 25.5% of target, reflecting the Compensation Committee's rigorous goal setting approach.
- Held all NEO base salaries flat from 2018 levels: no increases were made for 2019 or 2020.

Company Performance and Pay Alignment

The structure of the Company's compensation program coupled with the Compensation Committee's processes and decision-making ensure a strong tie between Company performance and executive pay. This is especially illustrated by the compensation outcomes for the Company's executive officers over the last three years. The chart below spotlights the direct relationship between total stockholder return ("TSR"), which is measured by stock price changes, and the realizable pay of our CEO based on the compensation the Compensation Committee has awarded to him.

Effect of Company Performance on CEO Realizable Pay(1)

Year	TSR for the Year	Salary increase following year end	Performance Cash Incentive Awarded, % of Target, Following Year End	Realizable Pay as a % of Target Pay measured at December 31, 2019
2019	-59.6%	No increase	18.7%	42.7%
2018	46.3%	No increase	117.0%	63.9%
2017	-19.1%	4%	105.2%	60.9%

(1) For a discussion of what constitutes "realizable pay" for this purpose, see the explanatory notes to the "CEO Target vs. Realizable Compensation" chart below.

Additional comparative detail about the tie between Company performance and NEO pay may be found below in the sections below titled "Pay and Performance Alignment in Our Target Compensation Mix," "Effect of Company Performance on Realizable Pay," "Annual Cash Incentive Program," and "Long-Term Incentive Compensation."

2019 Advisory Vote on Executive Compensation

Our board has adopted the recommendation of our stockholders to hold annual advisory votes on the compensation of our NEOs, or "say-on-pay" votes. At our 2019 annual meeting of stockholders, 79.6% of the stockholder votes cast were in favor of our 2018 executive compensation program, a significant improvement over the results of the say-on-pay vote at our 2018 annual meeting of stockholders. Our 2019 compensation program includes a number of changes implemented in response to stockholder feedback and the results of the say-on-pay vote at our 2018 annual meeting of stockholders, and we believe our significantly improved 2019 results reflect stockholders' approval of these changes. As further described below, we continue to engage actively with stockholders on our executive compensation program and remain committed to implementing compensation governance best practices and achieving pay for performance alignment.

Listening to Our Stockholders

While we were reviewing our executive compensation program in late 2018 and early 2019, members of our management team solicited engagement with stockholders for feedback around executive compensation. Later, in advance of our 2019 annual meeting of stockholders, our management extended invitations to discuss our proxy statement, including the compensation discussion and analysis and our executive compensation program, to a number of stockholders—including our top six institutional investors collectively representing approximately 60% of our then-outstanding common stock—to solicit their feedback and answer their questions. Based on the feedback received from stockholders during our engagement efforts, the Compensation Committee has made significant changes to our executive compensation program and we have enhanced our disclosures to provide a better picture of our current program.

Compensation Component	Our Prior Practice	Investor Feedback	What We Did in Response to Investor Feedback
Type of Equity Awards	Our equity awards granted to our executive officers were predominantly time-based.	Equity awards should include a meaningful amount of performance-based awards in addition to time-based awards.	We increased the portion of long-term compensation in PSUs to 51% of total LTI for 2019 (from 25% in 2018 and 0% in 2017) and then to 55% of total LTI for 2020.
Clawback Policy	We had not adopted a clawback policy prior to 2018.	Incentive compensation should be subject to a clawback.	In 2018, we adopted a clawback policy that is applicable to our CEO and all officers who report directly to the CEO, including our NEOs.
Stock Ownership Guidelines	Prior to 2018, we had not adopted stock ownership guidelines.	Executive officers and non-employee members of the Board should be subject to stock ownership guidelines.	In 2018, we adopted stock ownership guidelines for our CEO, our other senior executive officers, and the non-employee members of the Board.

Executive Compensation Governance Highlights

We believe that the following executive compensation-related practices, which were in effect during 2019, serve our stockholders' long-term interests:

What we do

- *Maintain an executive compensation program designed to align pay with performance*
- *Balance near- and long-term strategic objectives by providing a mix of cash and equity incentives*
- *Deliver the majority of compensation in the form of at-risk, variable pay*
- *Award performance-based equity grants—more than half of the equity awards granted to our executive officers in 2019 are subject to performance conditions over a 3-year period*
- *Benchmark compensation levels against appropriate companies operating in similar industries, of a similar size and business complexity*
- *Reference the market median when reviewing compensation for our executive officers*
- *Maintain stock ownership guidelines for our executive officers and directors*
- *Maintain an incentive compensation clawback policy*
- *Prohibit hedging and pledging of our common stock by our directors, officers, and others with access to material nonpublic information*
- *Conduct an annual assessment to identify and mitigate risk in compensation programs*
- *Hold an annual stockholder advisory vote*
- *Welcome and initiate direct engagement with stockholders*
- *Align compensation with the interests of stockholders*
- *Engage an independent consultant to advise on executive pay matters*
- *Maintain an all-independent Compensation Committee that meets in executive session without members of management present*

What we don't do

- *Allow excessive severance benefits or single trigger change in control payments*
- *Offer tax gross-ups to any of our executive officers*
- *Pay dividends on unvested equity awards*
- *Offer supplemental executive retirement plans*
- *Guarantee salary increases or bonuses for our executive officers*
- *Provide uncapped award opportunities*
- *Encourage excessive risk taking in our incentive plan designs*

Compensation Philosophy and Objectives

The Compensation Committee is responsible for establishing, implementing, and monitoring adherence with our compensation philosophy. The Compensation Committee seeks to ensure that the total compensation paid to our executive officers is fair and reasonable.

The primary goal of our executive compensation program is to ensure that we attract, hire, and retain talented and experienced executive officers who are motivated to achieve or exceed our corporate goals. We seek to have an executive compensation program that fosters synergy among our management team, incentivizes our executive officers to achieve our short-term and long-term goals, and fairly rewards our executive officers for corporate and individual performance. In determining the form and amount of compensation payable to our executive officers, we are guided by the following objectives and principles:

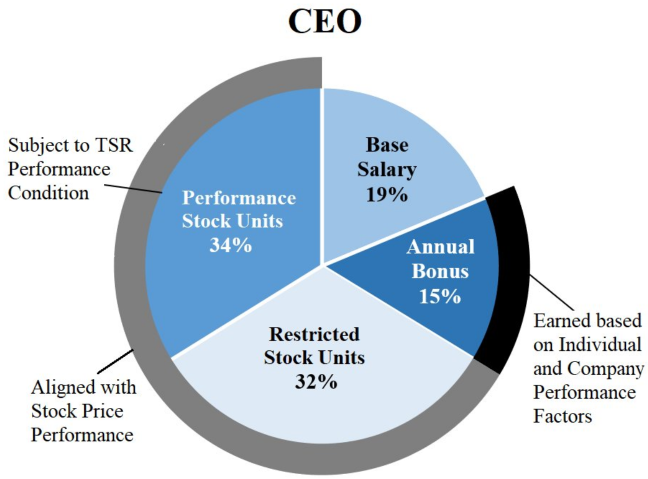
• ***Team-oriented approach to establishing compensation levels.***	We believe that it is critical that our executive officers work together as a team to achieve overall corporate goals rather than focusing exclusively on individual departmental objectives.
• ***Compensation should relate to performance.***	We believe that executive compensation should be directly linked to corporate as well as individual performance, with an emphasis on performance-based compensation.
• ***Equity awards help executive officers think like stockholders.***	We believe that our executive officers' total compensation should have a significant equity component because stock-based awards help reinforce the executive officers' long-term interest in our overall performance and align the interests of our executive officers with the interests of our stockholders.
• ***Total compensation opportunities should be competitive.***	We believe that our total compensation programs should be competitive so that we can attract, retain, and motivate talented executive officers who will help us to perform better than our competitors.

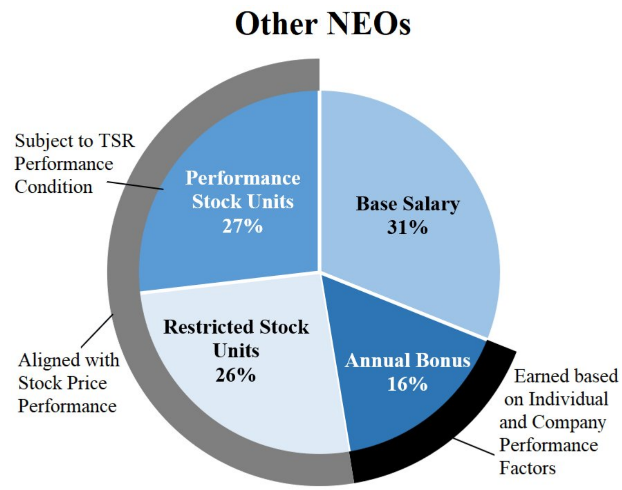
We consider total cash and equity compensation for our executive officers, consisting of base salary, cash incentive bonuses, and equity awards, at approximately the 50th percentile of our peer group as a general guideline for the appropriate level of total cash and equity compensation. An individual executive may be compensated above or below the guideline percentage based on factors such as performance, job criticality, experience and skill set. For 2019, we considered equity incentives for our executive officers at approximately the 50th percentile of our peer group as a general guideline for the appropriate level of equity compensation, but we did not attempt to benchmark equity compensation to any specific percentile. For new executive officer hires, we establish initial cash and equity compensation through arm's length negotiation at the time we hire the individual executive officer, taking into account his or her position, qualifications, experience, prior salary level, the compensation of our other executive officers, and the most recent compensation survey of our peer group.

Our Compensation Committee has not adopted any formal or informal policies or guidelines for allocating compensation between cash and non-cash compensation, among different forms of non-cash compensation, or with respect to long-term and short-term performance. The determination of our Compensation Committee as to the appropriate use and weight of each component of executive compensation is subjective, based on its views of the relative importance of each component in meeting our overall objectives and factors relevant to the executive officer.

Pay and Performance Alignment in Our Target Compensation Mix

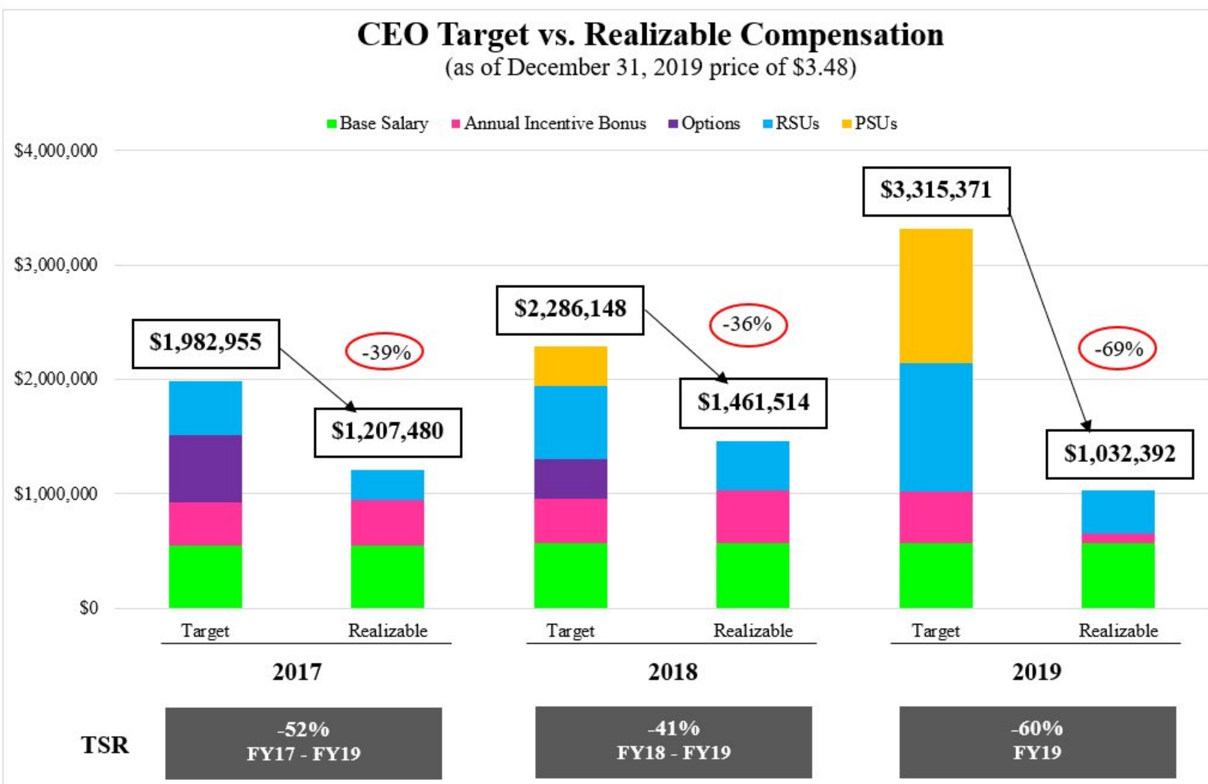
The Compensation Committee believes in a pay-for-performance compensation philosophy and intends to deliver a majority of target total executive pay opportunities through the annual cash incentive program and LTI. The charts below compare the percentage breakdown of target total direct compensation—comprising annual base salary, target cash incentive opportunity, and target LTI award—for 2019 for our CEO compared to our other NEOs. As illustrated below, more than 80% of our CEO's compensation is at risk in the form of annual cash incentive and LTI. For the other NEOs, more than 65% of compensation is at risk or variable. For purposes of the pie chart below and the table in the section entitled "*Elements of Executive Compensation*," we consider compensation to be at risk or variable if the compensation: (i) is earned subject to performance-based conditions; or (ii) varies as a result of performance, including stock price performance over time.





Effect of Company Performance on Realizable Pay

Changes in stock price and performance over the vesting or performance period of LTI cause the value ultimately received by the executive to differ from the target grant value. The measurement of realizable pay includes such changes when comparing pay received, or trending to be received, to the target pay granted. The chart illustrates the degree to which our CEO's realizable pay has been impacted by changes in the stock price after the grant date, illustrating the significant alignment of our executive compensation program with stockholder returns.



Notes:

- Target pay is defined as the sum of base salary, target cash incentive opportunity, and the grant date face value of LTI granted during the respective year (i.e., Black-Scholes for stock options and the closing price of our common stock on the date of grant for RSUs and PSUs). This target pay value differs from values disclosed in the Summary Compensation Table, which confirms with SEC requirements.

- Realizable pay defined as the sum of base salary, actual cash incentive earned, spread value of options granted during the respective year, RSUs granted in the respective year, and PSUs granted in the respective year at current projected payout levels (currently 0% for both the 2018-2020 and 2019-2021 cycles). LTI values calculated using the closing price of our common stock of $3.48 as of December 31, 2019.
- 2017 pay excludes grants made in connection with our stock option exchange program.

Compensation Process

Role of the Compensation Committee

The Compensation Committee has principal responsibility for reviewing our executive compensation structure, evaluating the performance of our executive officers relative to our corporate objectives, and considering and approving executive compensation. The fundamental responsibilities of our Compensation Committee are to:

- assist the Board in providing oversight of our compensation policies, plans, and benefit programs;
- assist the Board in discharging its responsibilities relating to oversight of the compensation of our executive officers (including officers reporting under Section 16 of the Exchange Act);
- review and approve or make recommendations to the Board with respect to executive officer compensation, plans, policies, and programs; and
- administer our equity compensation plans for executive officers and employees.

Our Compensation Committee:

- is made up of solely independent directors;
- meets in executive session without members of management present;
- engages an independent consultant to advise on executive pay matters;
- reviews its charter on a regular basis; and
- regularly reviews the realizable pay of the CEO and other executive officers in light of the Company's performance to ensure alignment of pay with performance.

In determining each executive officer's compensation, our Compensation Committee reviews our corporate financial performance and financial condition and assesses the performance of the individual executive officers. Individual executive officer performance is evaluated by our CEO, in the case of other executive officers, and by the Compensation Committee, in the case of our CEO. Our CEO does not participate in Compensation Committee or Board deliberations regarding his own compensation. Our CEO meets with the Compensation Committee to discuss executive compensation matters and to make recommendations to the Compensation Committee with respect to other executive officers. The Compensation Committee may modify individual compensation components for executive officers and is not bound to accept the CEO's recommendations. The Compensation Committee (or, in some cases, the independent members of the Board) makes all final compensation decisions for our executive officers. In addition, it is the Compensation Committee's practice to consult with the independent members of the Board prior to making material changes to our compensation policies.

Although we generally make many compensation decisions in the first quarter of the calendar year, the compensation evaluation process is ongoing. Compensation discussions and decisions are designed to promote our fundamental business objectives and strategy. Evaluation of management performance and rewards is performed annually or more often as needed.

Role of the Independent Compensation Consultant

Our Compensation Committee is authorized to engage the services of outside consultants. The Compensation Committee engaged Meridian Compensation Partners, LLC, an independent compensation consulting firm ("Meridian"), as its compensation consultant for 2019 to review our executive compensation program, assess the competitiveness of such program, and advise our Compensation Committee on matters related to executive compensation. During 2019, Meridian assisted the Compensation Committee by providing the following services:

- assisting us in confirming and updating an appropriate peer group of companies for purposes of benchmarking our levels of compensation;
- gathering and analyzing compensation data from available compensation surveys;
- advising us on policies related to executive officer and director stock ownership and structuring of such policies relative to peer group companies' publicly disclosed policies;
- conducting a twice yearly review of compliance and regulation updates related to executive compensation; and

- assisting us in assessing the competitiveness of our executive officer compensation program.

Meridian served at the discretion of and reported directly to the Compensation Committee. The Committee assessed Meridian's independence, taking into account, among other things, the independence standards and factors set forth in Exchange Act Rule 10C-1 and the applicable Nasdaq Listing Standards, and concluded that there were no conflicts of interest with respect to the work that Meridian performed for the Committee in 2019. Meridian did not provide any services to us or our management in 2019 other than those provided to the Committee and our Board as described below.

Use of Competitive Market Data

As directed by our Compensation Committee, Meridian developed an industry- and revenue size-appropriate peer group for purposes of benchmarking pay levels and practices. The benchmarking peer group includes companies in the medical device and biotechnology research-related industries that were comparable to us with respect to revenue. The benchmark companies considered by the Committee and Meridian as part of their executive compensation assessments (the "Peer Group") were as follows:

Alphatec Holdings	Enzo Biochem	Natera
Apollo Endosurgery	GenMark Diagnostics	Pacific Biosciences of California
AtriCure	Harvard Bioscience	Repligen
CareDx	Invitae	SeaSpine Holdings
Codexis	LeMaitre Vascular	SurModics
Cutera	Meridian Bioscience	Tandem Diabetes Care
Digirad	Mesa Laboratories	Veracyte
Endologix	NanoString Technologies	

With Meridian's assistance, the Compensation Committee used data from the Peer Group's public filings and Radford's Global Technology Survey to establish a competitive market range (+/- 15% of the median) within which individual pay could be positioned. Meridian provided the Compensation Committee with an analysis that identified the competitive market median range for each executive officer based on their respective, or substantially similar, positions at companies within the Peer Group. In cases where the data from the Peer Group was unavailable or insufficient, a competitive market median range was derived from survey data reflecting companies of comparative size and business profile.

Elements of Executive Compensation and Related Risk Profile

This section describes each component of compensation we pay to our executives.

Element	Description	Objective	Risk Profile
Base Salary	Fixed cash compensation	Provide competitive, fixed compensation to attract and retain exceptional executive talent	Low
Annual Cash Incentive Program	Annual cash compensation with payouts tied to financial results and individual performance	Increase alignment with stockholders by providing a direct financial incentive to achieve annual corporate financial goals	Moderate to High
RSUs	Awards vest 25% on the first anniversary of the grant date and then in equal quarterly installments over the next 3 years	Provide alignment with stockholders and promote retention through the 4-year service-vesting requirement	Moderate
PSUs	Awards vest after 3 years subject to relative TSR performance against the companies in the Russell 3000 Index	Provide performance incentives and align executives' interests with stockholders by rewarding sustained share price performance and promote retention through the service-vesting requirement	High

Base Salary

We pay an annual base salary to each of our executive officers in order to provide them with a fixed rate of cash compensation during the year. Our executive compensation philosophy is team-oriented as our success is dependent on our management team's ability to work together to accomplish our corporate objectives. Therefore, we seek to provide our non-CEO executive officers with generally comparable levels of base salary.

2019 Base Salary. The Compensation Committee annually reviews the base salaries of our executive officers, including the NEOs, and makes adjustments to base salaries as it determines to be necessary or appropriate. In February 2019, our Compensation Committee reviewed our executive officers' base salaries in light of 2018 performance ratings, Meridian's analysis identifying the median base salary ranges for each of our executive officers compared to their respective, or substantially similar, positions in the Peer Group or Radford's Global Technology Survey, and general compensation trends in our industry. As a result of this review, the Committee decided to maintain 2019 base salaries at the same levels as in 2018. The following table reflects the highest annualized base salaries for each of our NEOs for each of the past two fiscal years:

Named Executive Officer	2018 Base Salary	2019 Base Salary	2019 Base Salary Percentage Change
Stephen Christopher Linthwaite *President and CEO*	$564,720	$564,720	—
Vikram Jog *Chief Financial Officer*	$362,274	$362,274	—
Colin McCracken *Chief Commercial Officer*	—	$335,000(1)	—
Bradley Kreger *Senior Vice President, Global Operations*	$325,000	$325,000	—
Nicholas Khadder *Senior Vice President, General Counsel, and Secretary*	$347,471	$347,471	—

(1) Mr. McCracken joined the Company on March 1, 2019. This represents Mr. McCracken's annualized base salary at the time of hire.

Annual Cash Incentive Program

Our cash incentive program, which is adopted annually by the Compensation Committee pursuant to our Executive Bonus Plan, is intended to provide a significant portion of our executive officers' potential compensation. In contrast to the longer term incentives of equity incentive awards, our cash incentive program is designed to ensure that our executive officers are focused on our near-term performance and on working together to achieve key identified corporate objectives, typically weighted toward financial objectives, during the applicable fiscal year. We believe the program supports our "pay-for-performance" culture.

2019 Cash Incentive Program. In late 2018 and early 2019, our Compensation Committee, in conjunction with Meridian, reviewed our annual cash incentive program to ensure its focus on the Company's strategic imperatives and alignment with stockholder interests. The Committee structured the 2019 Cash Incentive Program with the objective of incentivizing revenue growth, cash management, and achievement of other strategic objectives applicable to each executive officer, described below under *Individual Performance Goals*.

Additionally, in an effort to increase the percentage of overall compensation that is tied to Company performance, the Compensation Committee increased the level of annual target cash incentive opportunity to 80.0% of base salary for our CEO and to between 50% and 55% for the other NEOs. The 2019 base salary, target cash incentive percentage, and target cash incentive amount for each NEO is set forth in the table below:

Named Executive Officer	Annualized Base Salary	Target Cash Incentive as a % of 2019 Base Salary	Target Cash Incentive Amount
Stephen Christopher Linthwaite	$564,720	80.0%	$451,776
Vikram Jog	$362,274	55.0%	$199,251
Colin McCracken[(1)]	$335,000	55.0%	$152,928
Bradley Kreger	$325,000	50.0%	$162,500
Nicholas Khadder	$347,471	50.0%	$173,735

(1) Mr. McCracken became eligible to participate in our 2019 Cash Incentive Program on his hire date in March 2019. The target cash incentive amount he was eligible to earn was based on his pro-rated salary from March to December 2019.

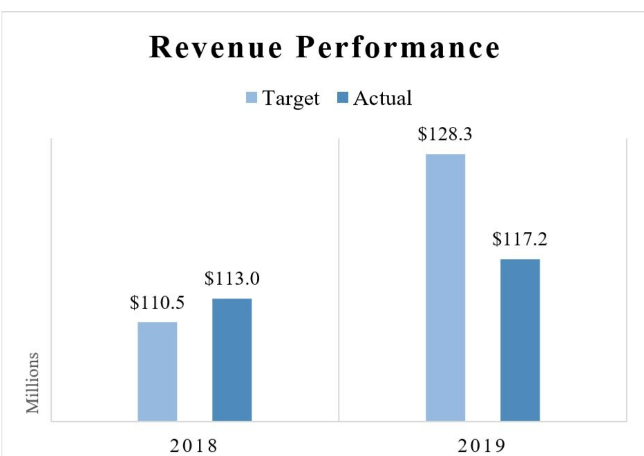
Cash Incentive Program Structure. Our 2019 Cash Incentive Program was based on the achievement of two corporate performance metrics—revenue and cash, weighted equally—and then adjusted in each case by an individual performance multiplier.

Corporate Performance Goals. The 2019 Cash Incentive Program was designed so that the bonus pool would fund at 100% if the Company achieved the revenue target of $128.3 million and the cash target of $71.6 million, with minimum thresholds of 90% of target revenue and 80% of target cash that had to be achieved in order to fund on a sliding scale up to 100%. If performance exceeded the target levels, the pool would be funded on a sliding scale based on the amount by which actual results exceeded the targets, up to a funding cap of 200% for substantial over-performance relative to target. No cash incentives would be paid under the 2019 Cash Incentive Program unless the minimum threshold revenue and cash conditions were satisfied.

Performance Measure	Weight	Threshold (% of Target)	Target ($M)	Maximum (% of Target)	FY2019 Result ($M)	Weighted Achievement vs. Target
Revenue	50%	90%	$128.3	120%	$117.2	6.8%
Cash	50%	80%	$71.6	136%	$60.7	11.9%
					Total Funding	**18.7%**

The Compensation Committee set the 2019 performance thresholds at amounts intended to incentivize revenue growth and effective operating expense and liquidity management, in each case above the performance levels actually achieved in 2018. The Company exceeded the minimum performance thresholds necessary to fund the 2019 Cash Incentive Program; however, as reflected below, the actual 2019 revenue and cash performance levels were achieved at 91.3% and 84.8% of target, respectively.

The following charts illustrate the performance targets set and the actual results achieved for the 2019 Cash Incentive Program as compared to the 2018 cash incentive program:



Individual Performance Goals. Some of the individual performance objectives identified for each of the executive officers are summarized below.

Named Executive Officer	Title	Individual Performance Goals
Stephen Christopher Linthwaite	President and CEO	Revenue Creation, Investor Attraction/ Retention, Expense Management
Vikram Jog	Chief Financial Officer	3-year Strategic Plan Development, Enterprise Risk Management (ERM), Extended Forecasting Accuracy
Colin McCracken	Chief Commercial Officer	Commercial Organization Development, Forecast Management, Revenue Development
Bradley Kreger	Senior Vice President, Global Operations	Current and Future ISO Compliance, Order & Inventory Management, Inventory Turn Management
Nicholas Khadder	Senior Vice President, General Counsel & Secretary	Compliance, Patent Application Process Oversight, Strategic Transactions

Cash Incentive Awards. In February 2020, the Compensation Committee reviewed and approved our performance against the revenue and cash targets. The achievement percentage associated with each target was determined by interpolating actual performance within the applicable performance range. In evaluating corporate performance relative to 2019 objectives, the Compensation Committee determined that the minimum threshold revenue and cash conditions had been satisfied, but that the Company had fallen short of both its revenue objective and its cash objective. The Committee then reviewed, with substantial input from Mr. Linthwaite with respect to the other executive officers, each executive officer's individual performance based in large part on achievements in the functional department overseen by that officer. The Committee approved the individual performance modifiers proposed by Mr. Linthwaite with respect to the other executive officers, and approved Mr. Linthwaite's individual performance modifier based on the Committee's evaluation of his performance. The following table lists some of the key achievements supporting the Compensation Committee's individual performance assessments for 2019.

Named Executive Officer	Key Achievements	Individual Performance Modifier
Stephen Christopher Linthwaite	• Achieved operating expense and gross margin targets • Recruited key talent (Executive and Board of Directors) • Recruited new sell side analyst coverage and new investors • Recognized as Top Employer: in December 2019, our Canadian operation cited as one of Greater Toronto's Top Employers for 2020 • Delivered new product innovation, including 10 new products and top industry award for new product innovation for the 2nd consecutive year	100%
Vikram Jog	• Deleveraged debt for equity trade exceeded expectations and stimulated significant appreciation in stock value • Increased communication with investment community and exceeded expectations in increasing credibility and support from investors and auditors	116%
Colin McCracken	• Exceeded transition objectives with the departure of the prior CCO • Implemented improved global forecasting process including standardized reporting and sales training	124%
Bradley Kreger	• Achieved targeted productivity gains in 2019 above expectations despite significant challenges in the factory environment • Overachieved on the complicated function move of the reagents team from South San Francisco to two separate operations sites while maintaining move-related turnover below objective targets	136%

The following table sets forth the actual cash incentives awarded for the 2019 performance period to each of the NEOs other than Mr. Khadder, who resigned at the beginning of 2020 and was not eligible to receive a bonus.

Named Executive Officer	Target Cash Incentive Amount	Cash Incentive Awarded	Cash Incentive Awarded as a % of 2019 Target Cash Incentive
Stephen Christopher Linthwaite	$451,776	$84,482	18.7%
Vikram Jog	$199,251	$43,260	21.7%
Bradley Kreger	$162,500	$41,388	25.5%
Colin McCracken[(1)]	$152,928	$35,326	23.1%
Nicholas Khadder	$173,735	—	N.A.

(1) Mr. McCracken became eligible to participate in our 2019 executive cash incentive program on his hire date, March 1, 2019. The estimated future payout amount Mr. McCracken was eligible to earn was based on his salary, pro-rated by month, from March to December 2019.

Committee Discretion. Under the Executive Bonus Plan, the Compensation Committee retains discretion to pay or eliminate bonuses irrespective of achievement of the pre-established goals. We believe that maintaining this flexibility is helpful in ensuring that executive officers are neither rewarded nor penalized as a result of unusual circumstances not foreseeable at the time the goals were developed.

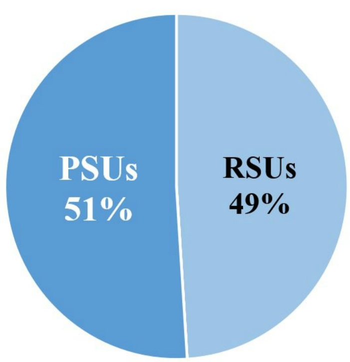
Long-Term Incentive Compensation

The largest component of our executive compensation program is long-term equity incentive awards. We believe that equity awards are an effective means of aligning the interests of executive officers and stockholders, rewarding executive officers for the Company's success over the long term, and providing executive officers an incentive to remain with us. We have historically granted equity awards to new executive officers upon the commencement of their employment and consider additional grants to existing executive officers annually, based on our overall corporate performance, individual performance, and the executive officers' existing equity grants and equity holdings.

2019 LTI Design

In 2019, the Compensation Committee granted 51% of target long-term incentive compensation in the form of PSUs and 49% in the form of time-based RSUs. The number of PSUs ultimately earned is calculated based on the TSR of our common stock as compared to the TSR of the companies in the Russell 3000 Index as of the beginning of 2019 (the "Russell 3000") during the performance period from January 1, 2019 to December 31, 2021. The percentage of PSUs that vest will depend on our relative position at the end of the performance period and can range from 0% to 200% of the number of units granted.

Mix of LTI for 2019



- **All LTI** is subject to the executive officer's continued service through the applicable vesting date(s).
- **RSUs** generally vest 25% on the first anniversary of the grant date and then in equal installments on a quarterly basis over the next three years.
- **PSUs** have two vesting components that must be met before the performance award vests: (i) a performance-based component and (ii) a time-based component. PSUs become eligible to vest at the end of 3 years subject to the Company's relative TSR performance against the Russell 3000. The Compensation Committee established threshold, target and maximum relative TSR performance levels and established a payout percentage curve that relates each level of performance to a payout expressed as a percentage of the target PSUs, as illustrated in the table below:

	Relative TSR Rank	% PSUs Earned[1]
Below Threshold	< 25th Percentile	0%
Threshold	25th Percentile	50%
Target	50th Percentile	100%
Maximum	75th Percentile	200%

(1) The number of PSUs that become eligible to vest (if any) will be linearly interpolated for relative TSR performance between the 25th and 50th percentile and for relative TSR performance between the 50th percentile and 75th percentile.

In the event of a change in control occurring before December 31, 2021, the performance period will end on the date of the closing of the change in control and the PSUs will vest based on the greater of (i) target and (ii) actual relative TSR rank over the shortened performance period, using an ending price equal to the per share amount payable to Company stockholders in the change in control.

2019 LTI Considerations

The 2019 executive LTI grants were approved by the Compensation Committee in February 2019. The Committee approved the LTI award opportunities for our executive officers other than the CEO based on the CEO's recommendations and the factors described above in *Compensation Philosophy and Objectives*. In approving Mr. Linthwaite's LTI award opportunity, the Compensation Committee contemplated the same philosophical factors as well as other considerations including:

- the Company's performance during Mr. Linthwaite's tenure as CEO through the February 2019 grant date;
- the Board's desire to retain his leadership;
- targeted market positioning as compared to an appropriately sized benchmarking peer group;
- the fact that Mr. Linthwaite did not receive an increase to base salary for 2019; and
- strengthened alignment of Mr. Linthwaite interests with those of the Company's stockholders.

Further, 51% of the LTI grant was made in the form of PSUs that would only be earned upon the Company's sustained relative TSR performance over three years. As indicated above, the current realizable value of this award (as with prior years' LTI awards) is well below grant date levels, demonstrating the Compensation Committee's commitment to linking pay with performance.

Grant Summary

The RSU and PSU awards granted to our NEOs in 2019 are set forth below.

	2019	
Named Executive Officer	**RSUs[1]**	**PSUs**
Stephen Christopher Linthwaite	110,112	114,607
Vikram Jog	35,787	37,247
Colin McCracken	76,455[2]	25,500
Bradley Kreger	35,787	37,247
Nicholas Khadder[3]	33,034	34,382

(1) RSUs vest over four years, with 1/4th of the total number of shares subject thereto vesting on February 20, 2020 and 1/16th of such shares vesting every three months thereafter until fully vested.

(2) Includes 51,955 RSUs received as new hire grants under the Inducement Plan, 10,391 of which vested on June 10, 2019.

(3) Mr. Khadder's resignation from the Company in March 2020 resulted in the cancellation and forfeiture of 24,776 then-unvested RSUs and all of the PSUs.

Response to Stockholder Feedback

In 2019, one of our largest stockholders expressed uncertainty as to whether relative TSR performance against the Russell 3000 was the most appropriate metric for the PSUs granted to our executive officers and suggested a reexamination of the design for future PSU grants.

In response to the stockholder feedback, our Compensation Committee directed its independent compensation consultant, Meridian, to analyze potential changes to our PSU design for the upcoming 2020 LTI grants, including the feasibility of using an industry-specific relative TSR index in lieu of the Russell 3000 and the replacement of relative TSR with one or more absolute metrics.

The Compensation Committee then carefully considered the results of Meridian's analysis, evaluating various alternatives, and determined that we would continue to use TSR as the performance measure for the PSUs granted to our executive officers in 2020, and that we would continue to use the Russell 3000 as the relative TSR comparator for such PSUs. The Committee made this determination, in part, because it believes that:

- TSR encourages long-term strategic focus on creation of stockholder value beyond executives' financial and operational targets;
- the current PSU design requires Fluidigm to out-perform a broad market index; and
- the analysis did not support a compelling reason to select an industry-specific comparison group over the Russell 3000.

The Compensation Committee also noted that, because the current PSU design was adopted in 2018 and no payouts have been realized to-date, no conclusion can yet be reached as to whether it is an effective measure of company performance.

Our Compensation Committee will continue to consider our stockholders' views when making future decisions regarding the structure and implementation of our executive compensation program.

Guidelines and Policies

Executive Officer Stock Ownership Guidelines

Our Board has approved stock ownership guidelines for our executive officers to further align their interests with the interests of our stockholders.

Pursuant to the guidelines, our CEO is expected to accumulate and hold a number of shares of our common stock equal to the lesser of (i) that number of shares with a value equal to three times his annual base salary or (ii) 265,300 shares and to maintain this minimum amount of stock ownership throughout his tenure as CEO. Under the guidelines, our other key executive officers, including our NEOs other than the CEO, are expected to accumulate and hold a number of shares of our common stock equal to the lesser of (i) that number of shares with a value equal to his or her annual base salary, or (ii) the number of shares determined by dividing his or her then-current annual base salary by $6.14 and to maintain this minimum amount of stock ownership throughout his or her tenure as a covered key executive officer. For purposes of determining share ownership under the guidelines, shares owned includes shares owned outright and vested in-the-money stock options, but does not include value or shares attributable to unvested time vesting restricted stock, unvested and/or out-of-the money stock options and/or unearned performance shares.

Our key executive officers, including our CEO and our other NEOs, are expected to achieve the applicable level of ownership by the end of the fiscal year that follows the five-year anniversary of the date he or she becomes covered by the guidelines.

In the event such an executive officer falls out of compliance with the guidelines at any time, he or she will be required to maintain 50% of the shares (net of tax and exercise costs) acquired through vesting or exercise of awards until the guidelines are again satisfied. The guidelines include a once-met-always-met policy such that each executive officer covered by our guidelines will be deemed to satisfy the guideline if they hold at least the number of shares that, as of the first measurement date they comply with the guidelines, was equal to the guideline value (i.e., following the initial compliance, the policy for each executive officer will reset to the lesser of the guideline value or the number of shares that originally satisfied the guideline).

Clawback Policy

Our Board has adopted a compensation clawback policy pursuant to which we may seek the recovery of performance-based cash and equity incentive compensation paid to our CEO and to all officers who report directly to the CEO, including our NEOs. The clawback policy provides that if (i) we restate our financial statements as a result of a material error; (ii) the amount of cash incentive compensation or performance-based equity compensation that was paid or is payable based on achievement of specific financial results paid to a participant would have been less if the financial statements had been correct; (iii) no more than two years have elapsed since the original filing date of the financial statements upon which the incentive compensation was determined; and (iv) our Compensation Committee unanimously concludes, in its sole discretion, that fraud or intentional misconduct by such participant caused the material error and it would be in our best interests to seek from such participant recovery of the excess compensation, then our Compensation Committee may, in its sole discretion, seek repayment from such participant.

No Hedging or Pledging

The Company's Insider Trading Policy prohibits all officers, directors, and other employees with access to sensitive Company information from engaging in any form of hedging transaction (derivatives, equity swaps, forwards, etc.) in the Company's stock, including, among other things, short sales and transactions involving publicly traded options. In addition, such officers, directors, and employees are prohibited from holding the Company's stock in margin accounts and from pledging the Company's stock as collateral for loans. We believe that these policies further align the interests of our officers and directors with those of our stockholders.

Other Benefits

Change of Control and Severance Plan

Each of our executive officers participates in our Change of Control and Severance Plan adopted in August 2017, which provides for specified payments and benefits if the executive officer's employment is terminated for a reason other than for cause, death or disability, or if the executive officer's employment is terminated by the executive officer for good reason, with the payments and benefits provided generally greater if such termination occurs in connection with a change of control. The terms of our executive officers' participation in the Change of Control and Severance Plan are described under the section entitled "*Potential Payments upon Termination or Change of Control.*"

Our Board concluded that it is in the best interests of our Company and our stockholders to provide assurances of specified benefits to certain of our employees, including our executive officers, whose employment is subject to being involuntarily terminated other than for death, disability, or cause or voluntarily terminated for good reason under the circumstances described in the plan. Our Board determined to provide such executive officers with certain severance benefits upon their termination of employment without cause outside of the change of control context in order to provide executive officers with enhanced financial security and incentive to remain with our Company. In addition, we believe that providing for acceleration of equity awards if an executive officer is terminated following a change of control transaction aligns the executive officer's interest more closely with those of other stockholders when evaluating the transaction rather than putting the executive officer at risk of losing the benefits of those equity incentives.

In determining the amount of cash payments, benefits coverage, and acceleration of vesting to be provided to executive officers upon termination, our Board considered the following factors:

- the expected time required for an executive officer to find comparable employment following a termination event;
- feedback received from potential candidates for executive officer positions at our Company as to the level of severance payments and benefits they would require in order to leave other employment and join our Company;
- in the context of a change of control, the amount of vesting acceleration that would align the executive officer's interests more closely with the interests of stockholders when considering a potential change of control transaction; and
- the period of time following a change of control during which management positions are evaluated and subject to a heightened risk of elimination.

Split Dollar Life Insurance

The Company has entered into an agreement with our CEO, Mr. Linthwaite, to pay the full amount of the premium of a life insurance policy covering him with an initial face amount of $2,500,000. We entered into this agreement for the purposes of ensuring Mr. Linthwaite's focus on increasing value for the stockholders. The value of the Company's payment of such premiums is treated as taxable income to Mr. Linthwaite. In the event of Mr. Linthwaite's death, Mr. Linthwaite's designated beneficiaries will receive $2,000,000 of the proceeds from the life insurance policy, and the Company will receive the remainder of the proceeds. The Company is entitled to 100% of the policy's cash value, less any policy loans and unpaid interest or prior cash withdrawals. The agreement will terminate upon the first to occur of: (i) Mr. Linthwaite's termination of employment for any reason before age 65; (ii) Mr. Linthwaite's reaching the age of 65 while employed by the Company; or (iii) the surrender, lapse, or other termination of the life insurance policy by the Company.

Employee Benefits

Executive officers are eligible to participate in all of our employee health and welfare plans, such as medical, dental, vision, group life, disability, accidental death and dismemberment insurance, as well as our 401(k) or comparable non-U.S. retirement plan, in each case on the same basis as our other employees, subject to applicable law. Subject to applicable limits, we match contributions made to U.S.-based employees' 401(k) defined contribution plans up to a maximum of $3,000 per year. We also provide vacation and other paid holidays to all employees, including our executive officers, which we believe are comparable to those provided at peer companies.

Accounting and Tax Considerations

Deductibility of Executive Compensation

Section 162(m) of the Internal Revenue Code of 1986, as amended (the "Code"), places a limit of $1,000,000 on the amount of compensation that we can deduct as a business expense in any year with respect to our CEO and certain of our other executive officers. While the Compensation Committee considers the deductibility of compensation as a factor in making compensation decisions, the Committee retains the flexibility to provide compensation that is consistent with our goals for our executive compensation program even if such compensation is not fully tax deductible.

Taxation of Nonqualified Deferred Compensation

Section 409A of the Code imposes additional taxes on certain non-qualified deferred compensation arrangements that do not comply with its requirements. These requirements regulate an individual's election to defer compensation and the individual's selection of the timing and form of distribution of the deferred compensation. Section 409A generally also provides that distributions of deferred compensation only can be made on or following the occurrence of certain events (i.e., the individual's separation from service, a predetermined date, a change in control, or the individual's death or disability). For certain executive officers, Section 409A requires that such individual's distribution commence no earlier than six months after such officer's separation from service. We have endeavored to structure our compensation arrangements to comply with Section 409A and will continue to do so. Further, we do not offer tax gross-ups related to Section 409A to any of our executive officers.

Accounting for Stock-Based Compensation

The impact of accounting treatment is considered in developing and implementing our compensation programs, including the accounting treatment as it applies to amounts awarded or paid to our executive officers.

Risk Management Considerations

In setting compensation, our Compensation Committee strives to create incentives that encourage a level of risk-taking consistent with our business strategy and to encourage a focus on building long-term value that does not encourage excessive risk-taking. In connection with its oversight of compensation-related risks, our Compensation Committee has reviewed our compensation programs and practices for employees, including executive and non-executive programs and practices. In its review, our Compensation Committee evaluated whether our policies and programs encourage unnecessary or excessive risk-taking and controls, and how such policies and programs are structured with respect to risks and rewards, as well as controls designed to mitigate any risks. As a result of this review, our Compensation Committee determined that any risks that may result from our compensation policies and practices for our employees are not reasonably likely to have a material adverse effect on the Company.

Compensation Committee Report

The Compensation Committee oversees Fluidigm's compensation policies, plans, and benefit programs. The Committee has reviewed and discussed the Compensation Discussion and Analysis required by Item 402(b) of Regulation S-K with management. Based on such review and discussions, the Committee has recommended to the Board that the Compensation Discussion and Analysis be included in this Proxy Statement.

The Compensation Committee

Nicolas Barthelemy (Chair)
Gerhard F. Burbach
Carlos Paya

The Compensation Committee Report does not constitute soliciting material, and shall not be deemed to be filed or incorporated by reference into any other filing by Fluidigm under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, except to the extent Fluidigm specifically incorporates the Compensation Committee Report by reference therein.

SUMMARY COMPENSATION TABLE FOR 2019

The following table provides information regarding the compensation of our CEO, Chief Financial Officer, and each of the next three most highly compensated executive officers during 2019. We refer to these individuals as our NEOs elsewhere in this report.

Name and Principal Position	Year	Salary ($)	Bonus ($)[1]	Stock Awards ($)[2]	Option Awards ($)[2]	Non-Equity Incentive Plan Compensation ($)[3]	All Other Compensation ($)	Total ($)
Stephen Christopher Linthwaite	2019	564,720	—	3,024,338	—	84,482	39,515[4]	3,713,055
President and CEO	2018	553,860	—	1,186,155	344,884	461,794	38,515	2,585,213
	2017	521,500	—	468,160	591,695	400,000	38,515	2,019,870
Vikram Jog	2019	362,274	—	982,911	—	43,260	3,000[5]	1,391,445
Chief Financial Officer	2018	355,979	122,122	341,734	99,312	204,390	2,000	1,125,539
	2017	344,592	—	213,136	272,898	141,500	2,000	974,126
Colin McCracken[6]	2019	246,800[7]	—	1,504,474	—	35,326	125,164[8]	1,911,764
Chief Commercial Officer								
Bradley Kreger[9]	2019	325,000	—	982,911	—	41,388	3,000[5]	1,352,299
Senior Vice President, Global Operations	2018	243,750	—	295,000	338,930	115,517	2,000	995,197
Nicholas Khadder[10]	2019	347,471	—	907,304	—	—	3,000[5]	1,257,775
Senior Vice President, General Counsel, and Secretary	2018	341,110	150,472	341,734	99,312	156,831	2,000	1,091,461
	2017	326,125	—	194,656	247,606	155,500	1,323	925,210

(1) Amounts represent the value of RSUs received pursuant to our retention bonus exchange program.

(2) Amounts represent the aggregate grant date fair value of equity awards granted to the NEO in the year indicated (other than the new options granted in the 2017 option exchange program), calculated in accordance with FASB Topic ASC 718 without regard to estimated forfeitures. The 2019 and 2018 PSUs were valued on the target outcome of performance-based conditions (i.e., based on 100% achievement); the maximum achievable outcome for such PSUs is 200%. See Note 10 of the notes to our audited consolidated financial statements included in our Form 10-K for a discussion of assumptions made in determining the grant date fair value and compensation expense of our equity awards.

(3) The amounts in this column represent total performance-based bonuses earned pursuant to our annual cash incentive program under the Executive Bonus Plan for service rendered during the applicable year. All such amounts were paid subsequent to year end. For a description of our annual cash incentive program, please see the section entitled "Annual Cash Incentive Program" under "Compensation Discussion and Analysis" above.

(4) Consists of Company contributions of $3,000 made to Mr. Linthwaite's 401(k) defined contribution plan, $27,500 of payments made by the Company for life insurance policy premiums, and $9,015 of payments made by the Company in disability insurance premiums.

(5) Consists of Company contributions made to the applicable NEO's 401(k) defined contribution plan.

(6) Mr. McCracken joined Fluidigm as Chief Commercial Officer in March 2019.

(7) Based on conversion of British Pounds (GBP) to US Dollars (USD) from March 1, 2019 to August 31, 2019 at a rate of 1 GBP to 1.2774 USD, and conversion of Canadian Dollars (CAD) to USD from September 1, 2019 to December 31, 2019 at a rate of 1 CAD to 0.7539 USD, the average exchange rates for the period beginning January 1, 2019 to December 31, 2019.

(8) Consists of Company contributions of $13,715 made to Mr. McCracken's UK pension plan from March 1, 2019 to August 31, 2019, $1,900 of payments made by the Company for Canadian comprehensive medical coverage premiums from September 1, 2019 to December 31, 2019, $64,615 of payments made by the Company for relocation expenses, $6,860 of payments made by the Company for car allowance, $31,500 of payments made by the Company for living expenses, and $6,574 of payments made by the Company for education and tuition amounts for Mr. McCracken's dependent child.

(9) Mr. Kreger joined Fluidigm as Senior Vice President, Global Operations in April 2018.

(10) Mr. Khadder's resignation from the Company in March 2020 resulted in the forfeiture of all of his then-unvested equity awards.

GRANTS OF PLAN BASED AWARDS

The following table presents information concerning each grant of an award made to an NEO in 2019 under any plan.

Name	Grant Date	Estimated Future Payouts Under Non-Equity Incentive Plan Awards ($)[1]			Estimated Future Payments Under Equity Incentive Plan Awards (#)			All Other Stock Awards: Number of Shares of Stock or Units (#)	Grant Date Fair Value of Stock and Option Awards ($)[2]
		Threshold	Target	Maximum	Threshold	Target	Maximum		
Stephen Christopher Linthwaite	02/05/2019[3]	406,598	451,776	1,129,440	—	—	—	—	—
	02/19/2019	—	—	—	57,303	114,607	229,214	—	1,897,892
	02/19/2019	—	—	—	—	—	—	110,112[4]	1,126,446
Vikram Jog	02/05/2019[3]	179,325	199,251	498,126	—	—	—	—	—
	02/19/2019	—	—	—	18,623	37,247	74,494	—	616,810
	02/19/2019	—	—	—	—	—	—	35,787[4]	366,101
Colin McCracken	02/05/2019[3][5]	137,635	152,928	382,319	—	—	—	—	—
	03/10/2019	—	—	—	—	—	—	41,564[6]	485,883
	03/10/2019	—	—	—	—	—	—	10,391[6]	121,471
	04/30/2019	—	—	—	12,750	25,500	51,000	—	560,490
	04/30/2019	—	—	—	—	—	—	24,500[4]	336,630
Bradley Kreger	02/05/2019[3]	146,250	162,500	406,250	—	—	—	—	—
	02/19/2019	—	—	—	18,623	37,247	74,494	—	616,810
	02/19/2019	—	—	—	—	—	—	35,787[4]	366,101
Nicholas Khadder	02/05/2019[3]	156,362	173,735	434,338	—	—	—	—	—
	02/19/2019	—	—	—	17,191	34,382	68,764	—	569,366
	02/19/2019	—	—	—	—	—	—	33,034[4]	337,938

(1) The target amounts shown in this column reflect our annual incentive plan awards provided under our 2019 Cash Incentive Program. The maximum amounts in this column reflect the greatest payouts that could be made if pre-established maximum performance levels were met or exceeded. Actual 2019 Cash Incentive Program payouts are reflected in the non-equity incentive plan compensation column of the Summary Compensation Table.

(2) All amounts reported represent the grant date fair value of the equity awards, calculated in accordance with FASB ASC Topic 718 without regard to estimated forfeitures. See Note 10 of the notes to our audited consolidated financial statements included in our Form 10-K for a discussion of assumptions made in determining the grant date fair value.

(3) Corresponds to the date on which our Compensation Committee set the target cash incentive amounts payable to each of our executive officers pursuant to our 2019 Cash Incentive Program. Under our 2019 Cash Incentive Program, the payouts were based on achievement of Company and individual performance goals, as discussed in the section of our Compensation Discussion & Analysis titled "2019 Cash Incentive Program — Cash Incentive Program Structure."

(4) Represents awards granted under our 2011 Plan.

(5) Mr. McCracken joined Fluidigm as Chief Commercial Officer on March 1, 2019 and was eligible to participate in the 2019 Cash Incentive Program as of his start date.

(6) Represents awards granted under our Inducement Plan.

OUTSTANDING EQUITY AWARDS AT FISCAL YEAR-END FOR 2019

The following table presents information concerning unexercised options and unvested stock awards outstanding as of December 31, 2019 for each NEO. Each outstanding equity award was granted pursuant to our 2011 Plan except where indicated. Vesting in all instances is subject to the NEO's continued service through the applicable vesting date.

	Option Awards					Stock Awards			
Name	Number of Securities Underlying Unexercised Options (#) Exercisable	Number of Securities Underlying Unexercised Options (#) Unexercisable	Equity Incentive Plan Awards: Number of Securities Underlying Unexercised Unearned Options (#)	Option Exercise Price ($)	Option Expiration Date	Number of Shares or Units of Stock that Have Not Vested (#)	Market Value of Shares or Units of Stock that Have Not Vested ($)[1]	Equity Incentive Plan Awards: Number of Unearned Shares, Units or Other Rights That Have Not Vested (#)	Equity Incentive Plan Awards: Market or Payout Value of Unearned Shares, Units or Other Rights That Have Not Vested ($)[1]
Stephen Christopher	110,833[2]	29,167	—	4.99	11/8/2026	22,167[3]	77,141	—	—
Linthwaite	138,174[4]	51,326	—	6.16	2/13/2027	78,128[5]	271,885	—	—
	46,666[6]	23,334	—	5.13	9/20/2027	110,112[7]	383,190	—	—
	41,786[8]	53,714	—	6.33	3/19/2028	—	—	54,500[9]	189,660
	—	—	—	—	—	—	—	114,607[10]	398,832
Vikram Jog	63,728[4]	23,672	—	6.16	2/13/2027	226[11]	786	—	—
	1,027[6]	514	—	5.13	9/20/2027	10,092[3]	35,120	—	—
	1,382[6]	691	—	5.13	9/20/2027	22,510[5]	78,335	—	—
	2,296[6]	1,148	—	5.13	9/20/2027	35,787[7]	124,539	—	—
	4,406[6]	2,203	—	5.13	9/20/2027	—	—	15,700[9]	54,636
	5,960[6]	2,981	—	5.13	9/20/2027	—	—	37,247[10]	129,620
	644[6]	323	—	5.13	9/20/2027	—	—	—	—
	12,033[8]	15,467	—	6.33	3/19/2028	—	—	—	—
Colin McCracken	—	—	—	—	—	41,564[12][13]	144,643	—	—
	—	—	—	—	—	24,500[13]	85,260	—	—
	—	—	—	—	—	—	—	25,500[10]	88,740
Bradley Kreger	41,673[12][14]	58,327	—	5.90	4/30/2028	31,250[12][15]	108,750	—	—
	—	—	—	—	—	35,787[7]	124,539	—	—
	—	—	—	—	—	—	—	37,247[10]	129,620
Nicholas Khadder[16]	9,000[6]	4,500	—	5.13	9/20/2027	1,575[17]	5,481	—	—
	37,762[6]	18,881	—	5.13	9/20/2027	9,217[3]	32,075	—	—
	12,033[8]	15,467	—	6.33	3/19/2028	22,510[5]	78,335	—	—
	—	—	—	—	—	33,034[7]	114,958	—	—
	—	—	—	—	—	—	—	15,700[9]	54,636
	—	—	—	—	—	—	—	34,382[10]	119,649

(1) Based on the closing price of our common stock of $3.48 per share on December 31, 2019, as reported on the Nasdaq Global Select Market, and the number of RSUs and PSUs that had not vested as of December 31, 2019.
(2) The option vests over four years, with 1/4th of the total number of shares subject thereto vesting on October 19, 2017 and 1/48th of such shares vesting monthly thereafter until fully vested.
(3) The RSUs vest over four years, with 1/12th of the total number of shares subject thereto vesting on May 20, 2017 and 1/16th of such shares vesting every three months thereafter until fully vested.
(4) The option vests over four years, with 5/16th of the total number of shares subject thereto vesting on March 1, 2018 and 1/48th of such shares vesting monthly thereafter until fully vested.
(5) The RSUs vest over four years, with 1/16th of the total number of shares subject thereto vesting on August 20, 2018 and 1/16th of such shares vesting every three months thereafter until fully vested.
(6) The option vests over four years, with 1/12th of the total number of shares subject thereto vesting on February 20, 2018 and 1/12th of such shares vesting every three months thereafter until fully vested.
(7) The RSUs vest over four years, with 1/4th of the total number of shares subject thereto vesting on February 20, 2020 and 1/16th of such shares vesting every three months thereafter until fully vested.
(8) The option vests over four years, with 1/4th of the total number of shares subject thereto vesting on March 19, 2019 and 1/48th of such shares vesting monthly thereafter until fully vested.
(9) These PSUs become eligible to vest at the end of three years subject to the Company's relative TSR performance against the Russell 3000 Index as of the beginning of 2018 during the performance period from January 1, 2018 to December 31, 2020. The percentage of

PSUs that vest will depend on our relative position at the end of the performance period and can range from 0% to 200% of the number of units granted.

(10) These PSUs become eligible to vest at the end of three years subject to the Company's relative TSR performance against the Russell 3000 Index as of the beginning of 2019 during the performance period from January 1, 2019 to December 31, 2021. The percentage of PSUs that vest will depend on our relative position at the end of the performance period and can range from 0% to 200% of the number of units granted.

(11) The RSUs vest over four years, with $1/12^{th}$ of the total number of shares subject thereto vesting on May 20, 2016 and $1/16^{th}$ of such shares vesting every three months thereafter until fully vested.

(12) Represents RSUs granted under our Inducement Plan.

(13) The RSUs vest over four years, with $1/4^{th}$ of the total number of shares subject thereto vesting on May 20, 2020 and $1/16^{th}$ of such shares vesting every three months thereafter until fully vested.

(14) The option vests over four years, with $1/4^{th}$ of the total number of shares subject thereto vesting on April 2, 2019 and $1/48^{th}$ of such shares vesting monthly thereafter until fully vested.

(15) The RSUs vest over four years, with $1/4^{th}$ of the total number of shares subject thereto vesting on May 20, 2019 and $1/16^{th}$ of such shares vesting every three months thereafter until fully vested.

(16) Mr. Khadder's resignation from the Company in March 2020 resulted in the forfeiture of all of his unvested equity awards.

(17) The RSUs vest over four years, with $7/24^{th}$ of the total number of shares subject thereto vesting on August 20, 2017 and $1/16^{th}$ of such shares vesting every three months thereafter until fully vested.

OPTION EXERCISES AND STOCK VESTED IN 2019

The following table provides additional information about the value realized by the NEOs upon option award exercises and the vesting of RSU awards during the year ended December 31, 2019.

	Option Awards		Stock Awards	
Name	**Number of Shares Acquired on Exercise (#)**	**Value Realized on Exercise ($)**	**Number of Shares Acquired on Vesting (#)**	**Value Realized on Vesting ($)[(1)]**
Stephen Christopher Linthwaite	—	—	50,248	392,688
Vikram Jog	—	—	19,205	150,683
Colin McCracken	—	—	10,391	133,940
Bradley Kreger	—	—	18,750	177,813
Nicholas Khadder	—	—	19,604	153,205

(1) Value realized on vesting of stock awards is based on the closing price of our common stock on the vesting date and does not necessarily reflect actual proceeds received.

As of December 31, 2019, our NEOs had not been awarded any equity awards other than RSUs and PSUs.

Pension Benefits & Nonqualified Deferred Compensation

We do not provide a pension plan for our employees and no NEOs participated in a nonqualified deferred compensation plan during the fiscal year ended December 31, 2019.

Potential Payments Upon Termination or Change of Control

The Compensation Committee has approved a Change of Control and Severance Plan (the “Severance Plan”) under which our NEOs, other executive officers, and certain other designated employees are eligible to receive severance benefits.

We adopted the Severance Plan because we recognize that we will from time to time consider the possibility of an acquisition by another company or other change of control transaction and that such consideration can cause such executive officers to consider alternative employment opportunities.

We have entered into individual participation agreements with each of our NEOs under our Change of Control and Severance Plan (our “Severance Plan”), which provides for the following payments and benefits if the NEO’s employment with us is terminated in certain circumstances.

Under the Severance Plan, if any NEO’s employment is terminated outside of the period beginning 3 months before a change of control (as defined in the Severance Plan) and ending 12 months after a change of control (such period, the “Change of Control Period”) for a reason other than cause or the NEO’s death or disability (as such terms are defined in the Severance Plan), then, subject to the Severance Conditions (as defined below), the NEO will be entitled to receive the following severance benefits:

- Continued payments (less applicable withholdings) totaling 75% of the NEO’s annual base salary in effect as of the date of termination in equal installments over a period of nine months (or, in the case of our CEO, 200% of his annual base salary paid in equal installments over a period of 24 months) following his termination.
- Reimbursement of costs of continued health coverage for the NEO, his or her spouse, and/or his or her dependents, as applicable, for a period of up to 9 months (or, in the case of our CEO, 12 months) following termination.
- Reasonable outplacement services in accordance with any applicable policy of ours that is in effect as of the NEO’s termination (or if no such policy is in effect, as determined by us).

Under the Severance Plan, if any NEO’s employment is terminated within the Change of Control Period either (i) by us for a reason other than cause or the NEO’s death or disability or (ii) by the NEO for good reason (as defined in the NEO’s participation agreement under the Severance Plan), then, subject to the Severance Conditions, the NEO will be entitled to receive the following severance benefits:

- A lump-sum payment (less applicable withholdings) totaling 150% (or, in the case of our CEO, 200%) of the sum of (x) his or her annual base salary (as in effect immediately before termination or immediately before the change of control, whichever is higher) plus (y) the greater of (A) his or her annual target cash incentive (as in effect immediately before termination or immediately before the change of control, whichever is higher) or (B) the average of the annual cash incentives actually paid to him or her for the three fiscal years preceding the year in which his or her termination occurs.

- Reimbursement of costs of continued health coverage for the NEO, his or her spouse, and/or his or her dependents, as applicable, for a period of up to 18 months (or, in the case of our CEO, 24 months) following termination.
- 100% vesting acceleration of his or her then-outstanding and unvested equity awards, provided that, if an equity award is to vest and/or the amount of the award to vest is to be determined based on the achievement of performance criteria, then, unless otherwise provided in the applicable equity award agreement, 100% of such equity award will vest assuming the applicable performance criteria had been achieved at target levels for the relevant performance period(s).
- Reasonable outplacement services in accordance with any applicable policy of ours that is in effect as of the NEO's termination (or if no such policy is in effect, as determined by us), except that such outplacement services will be in no case less than the outplacement services provided under any applicable policy of ours that is in effect immediately prior to the applicable change of control.

The Severance Plan superseded the severance benefits provided to our NEOs under the Company's previous existing forms of amended and restated employment and severance agreement. To receive the Severance Plan benefits, the NEO would also be required sign and not revoke a separation and release of claims agreement in a form reasonably satisfactory to us within the period set forth in the Severance Plan and be in compliance with any confidentiality, proprietary information and inventions assignment agreement and any other appropriate agreement between the NEO and us (together, the "Severance Conditions").

If any of the severance and other benefits provided for in the Severance Plan or otherwise payable to a NEO ("280G Payments") constitute "parachute payments" within the meaning of Section 280G of the Internal Revenue Code and could be subject to excise tax under Section 4999 of the Internal Revenue Code, then the 280G Payments will be delivered in full or delivered as to such lesser extent which would result in no portion of such benefits being subject to excise tax, whichever results in the greater amount of after-tax benefits to such NEO. The Severance Plan does not require us to provide any tax gross-up payment to any NEO participating in the Severance Plan.

Subject to earlier termination in accordance with the terms and conditions of the Severance Plan, the Severance Plan will automatically terminate 3 years following its adoption by the Compensation Committee, but if a change of control occurs, the expiration date of the Severance Plan will be extended automatically through the date 12 months following a change of control.

The following table describes the payments and benefits that each of our NEOs would be entitled to receive pursuant to the Severance Plan, assuming that each of the following triggers occurred on December 31, 2019: (i) their employment was terminated for a reason other than for "cause" or the NEO's death or "disability" more than 3 months prior to or after 12 months following a "change of control" and (ii) their employment was terminated for a reason other than for "cause" or the NEO's death or "disability" or by them for "good reason" within 3 months prior to or 12 months following a "change of control."

	Employment Terminated for Reason Other than Cause, Death, or Disability More Than 3 Months Prior to, or More Than 12 Months After, a Change of Control		**Employment Terminated for Reason Other Than Cause, Death or Disability Within 3 Months Prior to or 12 Months After a Change of Control**(1)		
Name	**Severance Payments ($)**	**Health Care Benefits ($)**	**Equity Acceleration ($)**(2)	**Severance Payments ($)**	**Health Care Benefits ($)**
Stephen Christopher Linthwaite . . .	1,129,440(3)	28,346(4)	1,320,709	2,032,992(5)	56,691(6)
Vikram Jog.	271,706(7)	21,259(8)	423,036	842,286(9)	42,518(10)
Colin McCracken.	251,250(7)	2,689(11)	318,643	778,875(9)	5,378(12)
Bradley Kreger	243,750(7)	21,259(8)	362,908	731,250(9)	42,518(10)
Nicholas Khadder	260,603(7)	21,259(8)	405,135	781,809(9)	42,518(10)

(1) Includes termination of the employee's employment by the Company or its successor without "cause" and termination by the employee for "good reason."

(2) We estimate the value of the acceleration of options and RSUs held by the NEO based on the closing stock price of our common stock of $3.48 per share on December 31, 2019, as reported on the Nasdaq Global Select Market, and the number of unvested in-the-money options and shares held by such NEO as of December 31, 2019.

(3) The amount shown is equal to 200% of Mr. Linthwaite's annual base salary as of December 31, 2019.

(4) The amount shown is equal to the cost of covering Mr. Linthwaite and his eligible dependents under our benefit plans for a period of 12 months, assuming that such coverage is timely elected under COBRA.

(5) The amount shown is equal to 200% of the sum of (a) Mr. Linthwaite's annual base salary as of December 31, 2019, plus (b) his annual target cash incentive as of December 31, 2019.

(6) The amount shown is equal to the cost of covering Mr. Linthwaite and his eligible dependents under our benefit plans for a period of 24 months, assuming that such coverage is timely elected under COBRA.
(7) The amount shown is equal to 75% of the NEO's annual base salary as of December 31, 2019.
(8) The amount shown is equal to the cost of covering the NEO and his eligible dependents under our benefit plans for a period of nine months, assuming that such coverage is timely elected under COBRA for such U.S.-based NEO.
(9) The amount shown is equal to 150% of the sum of (a) the NEO's annual base salary as of December 31, 2019, plus (b) his annual target cash incentive as of December 31, 2019.
(10) The amount shown is equal to the cost of covering the NEO and his eligible dependents under our benefit plans for a period of 18 months, assuming that such coverage is timely elected under COBRA for such U.S.-based NEO.
(11) The amount shown is equal to the cost of covering Mr. McCracken and his eligible dependents under our Canadian benefit plans for a period of 9 months. Based on conversion of Canadian Dollars (CAD) to USD at a rate of 1 CAD to 0.7539 USD, the average exchange rates for the period beginning January 1, 2019 to December 31, 2019.
(12) The amount shown is equal to the cost of covering Mr. McCracken and his eligible dependents under our Canadian benefit plans for a period of 18 months. Based on conversion of CAD to USD at a rate of 1 CAD to 0.7539 USD, the average exchange rates for the period beginning January 1, 2019 to December 31, 2019.

In addition to the benefits described above, our 2011 Plan, 2009 Equity Incentive Plan (the "2009 Plan"), and Inducement Plan provide for full acceleration of all outstanding options in the event of a change of control of our Company where the successor company does not assume our outstanding options and other awards in connection with such acquisition transaction. We estimate the value of this benefit for each NEO to be equal to the amount listed above in the column labeled "Equity Acceleration."

CEO PAY RATIO

Under rules adopted pursuant to the Dodd-Frank Act, we are required to calculate and disclose the total compensation paid to our median paid employee, as well as the ratio of the total compensation paid to the median employee as compared to the total compensation paid to our CEO (the "CEO Pay Ratio"). The paragraphs that follow describe our methodology and the resulting CEO Pay Ratio.

Measurement Date

We identified the median employee using our employee population on December 31, 2019 (including all employees, whether employed on a full-time, part-time, seasonal or temporary basis).

Consistently Applied Compensation Measure

Under the relevant rules, we are required to identify the median employee by use of a "consistently applied compensation measure" ("CACM"). We chose a CACM that closely approximates the annual target total direct compensation of our employees. Specifically, we identified the median employee by aggregating, for each employee as of December 31, 2019: (i) annual base pay, (ii) annual target cash incentive opportunity, and (iii) the grant date fair value for equity awards granted in 2019. In identifying the median employee, we converted compensation amounts paid in foreign currencies based on the applicable year-to-date average exchange rate as of December 31, 2019, and annualized the compensation values of individuals that joined our Company during 2019. Pursuant to the de minimis exemption, we excluded 11 employees based in Japan as of December 31, 2019. As there were an even number of employees, two individuals were identified as the median. We selected from among these a U.S.-based individual whose annual total compensation for 2019 was within 1% of the CACM.

Methodology and Pay Ratio

After applying our CACM methodology, we identified the two median employees. As a result, we selected the individual who is a U.S. employee and whose compensation was closest to the CACM estimate. Once the median employee was identified, we calculated the median employee's annual target total direct compensation in accordance with the requirements of the Summary Compensation Table.

Our median employee's compensation in 2019 as calculated using Summary Compensation Table requirements was $100,351. Our CEO's compensation in 2019 as reported in the Summary Compensation Table was $3,713,055. Therefore, our CEO Pay Ratio for 2019 is 37:1.

This information is being provided for compliance purposes and is a reasonable estimate calculated in a manner consistent with the SEC rules, based on our internal records and the methodology described above. The SEC rules for identifying the median compensated employee allow companies to adopt a variety of methodologies, to apply certain exclusions and to make reasonable estimates and assumptions that reflect their employee populations and compensation practices. Accordingly, the pay ratio reported by other companies may not be comparable to the pay ratio reported above, as other companies have different employee populations and compensation practices and may use different methodologies, exclusions, estimates and assumptions in calculating their own pay ratios. Neither the Compensation Committee nor management of the Company used the CEO Pay Ratio measure in making compensation decisions.

EQUITY COMPENSATION PLAN INFORMATION

The following table summarizes the number of outstanding options and RSUs granted to our employees, consultants, and directors, as well as the number of shares of common stock remaining available for future issuance, under our equity compensation plans as of December 31, 2019. A description of each of our equity compensation plans is incorporated by reference to Note 10 to the consolidated financial statements set forth in our Form 10-K.

	Number of Securities to be Issued Upon Exercise of Outstanding Options, Warrants and Rights (a)	Weighted Average Exercise Price of Outstanding Options, Warrants and Rights (b)	Number of Securities Remaining Available for Future Issuance Under Equity Compensation Plans (Excluding Securities Reflected in Column (a))
Equity compensation plans approved by security holders			
2009 Equity Incentive Plan[(1)]	27,904	$ 7.15	—
2011 Equity Incentive Plan	4,598,599	$ 8.05	5,312,076
2017 Employee Stock Purchase Plan	—	—	401,265
Equity compensation plans not approved by security holders			
DVS Sciences, Inc. 2010 Equity Incentive Plan[(2)]	22,918	$ 0.94	—
2017 Inducement Award Plan[(3)]	539,064	$ 6.30	—
Total	5,188,485	$ 7.78	

(1) The 2009 Plan was replaced by the 2011 Plan in February 2011. A total of 55,423 shares remaining available for grant under the 2009 Plan were transferred to the 2011 Plan and the 2009 Plan was terminated for any new grants.
(2) Represents awards assumed in connection with our acquisition of DVS Sciences, Inc. in February 2014.
(3) The Inducement Plan was terminated in June 2019 for any new grants.

RELATED PERSON TRANSACTIONS AND SECTION 16(a) BENEFICIAL OWNERSHIP REPORTING COMPLIANCE

Related Person Transactions

None.

Policy Concerning Audit Committee Approval of Related Person Transactions

Our Board and Audit Committee have adopted a formal written policy that our executive officers, directors, holders of more than 5% of any class of our voting securities, and any member of the immediate family of any of the foregoing persons, are not permitted to enter into any transaction with us for which disclosure would be required under Item 404 of Regulation S-K, referred to as a related person transaction, without the review and approval or ratification of our Audit Committee, or other independent members of our Board if it is inappropriate for our Audit Committee to review such transaction due to a conflict of interest. Any related person transaction must be presented to our Audit Committee for review, consideration and approval or ratification. In approving or rejecting any such related person transaction, our Audit Committee is to consider the relevant facts and circumstances available and deemed relevant to the Audit Committee, including, but not limited to, 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.

Section 16(a) Beneficial Ownership Reporting Compliance

Section 16(a) of the Securities Exchange Act of 1934, as amended, or the Exchange Act, requires our directors, executive officers, and holders of more than 10% of our common stock to file with the SEC reports regarding their ownership and changes in ownership of our securities. We believe that our directors, executive officers, and 10% stockholders complied with all Section 16(a) filing requirements in 2019. In making these statements, we have relied upon examination of the filings made with the SEC and the written representations of our directors and executive officers.

SECURITY OWNERSHIP

Except as indicated by the footnotes below, the following table sets forth information as of May 1, 2020 concerning:

- Each person we believe to be the beneficial owner of more than five percent of our common stock;
- Each of our directors and nominees for the Board;
- Each of our NEOs; and
- All of our directors and executive officers as a group.

Unless otherwise noted below, the address of each person listed on the table is c/o Fluidigm Corporation, 2 Tower Place, Suite 2000, South San Francisco, California 94080.

We have determined beneficial ownership in accordance with the rules of the SEC. Except as otherwise indicated, we believe, based on the information furnished to us, that the persons and entities named in the table below have sole voting and investment power with respect to all shares of common stock that they beneficially own, subject to applicable community property laws.

Applicable percentage ownership is based on 70,706,062 shares of common stock outstanding at May 1, 2020. In computing the number of shares of common stock beneficially owned by a person and the percentage ownership of that person, we deemed outstanding shares of common stock subject to options held by that person that are currently exercisable, options held by that person that are exercisable within 60 days of May 1, 2020, and RSUs that are scheduled to vest within 60 days of May 1, 2020. We did not deem these shares outstanding, however, for the purpose of computing the percentage ownership of any other person.

The information provided in the table is based on our records, information filed with the SEC, and information provided to Fluidigm, except where otherwise noted.

Name of Beneficial Owner	Shares Beneficially Owned	Percent of Shares Beneficially Owned
5% Stockholders:		
Indaba Capital Management, L.P.[(1)]	7,278,524	9.7%
PRIMECAP Management Company[(2)]	6,477,843	9.2%
Neuberger Berman Group LLC[(3)]	5,669,341	8.0%
BlackRock, Inc.[(4)]	5,290,321	7.5%
Levin Easterly Partners LLC[(5)]	5,128,573	7.3%
The Vanguard Group[(6)]	4,409,776	6.2%
Directors and NEOs:		
Stephen Christopher Linthwaite[(7)]	618,290	*
Nicolas M. Barthelemy[(8)]	180,886	*
Gerhard F. Burbach[(9)]	134,598	*
Laura M. Clague[(10)]	17,033	*
Samuel D. Colella[(11)]	255,250	*
Bill W. Colston	—	—
Patrick S. Jones[(12)]	139,483	*
Carlos V. Paya[(13)]	79,989	*
Vikram Jog[(14)]	221,239	*
Nicholas S. Khadder[(15)]	116,454	*
Bradley Kreger[(16)]	78,936	*
Colin McCracken[(17)]	22,023	*
All current directors and executive officers as a group (12 persons)[(18)]	1,864,181	2.6%

*Less than one percent.

(1) Information is as of December 31, 2019, the latest date for which information is available to the Company. According to a Schedule 13G filed jointly by Indaba Capital Management, L.P., IC GP, LLC ("IC GP"), Indaba's sole general partner, and Derek C. Schrier, the managing member of IC GP, shared voting and dispositive power is held with respect with respect to all of such shares. Reported shares include 3,955,536 shares issuable upon conversion of our 5.25% Convertible Senior Notes due 2024. Percentage beneficially

owned is based on 74,661,598 outstanding shares. Indaba's address is One Letterman Drive, Building D, Suite DM700, San Francisco, CA 94129.

(2) Information is as of December 31, 2019, the latest date for which information is available to the Company. According to a Schedule 13G/A filed by PRIMECAP Management Company, which identified itself as an investment adviser, sole voting and dispositive power is held with respect to all of such shares. PRIMECAP's address is 177 E. Colorado Blvd., 11th Floor, Pasadena, CA 91105.

(3) Information is as of December 31, 2019, the latest date for which information is available to the Company. According to a Schedule 13G/A filed jointly by Neuberger Berman Group LLC, which identified itself as a parent holding company, and Neuberger Berman Investment Advisers LLC, which identified itself as an investment adviser, shared dispositive power is held with respect to all of such shares and shared voting power is held with respect to 4,622,395 shares. Neuberger Berman's address is 1290 Avenue of the Americas, New York, NY 10104.

(4) Information is as of December 31, 2019, the latest date for which information is available to the Company. According to a Schedule 13G filed by BlackRock, Inc., which identified itself as a parent holding company, sole dispositive power is held with respect to all of such shares and sole voting power is held with respect to 5,186,586 shares. BlackRock's address is 55 East 52nd Street, New York, NY 10055.

(5) Information is as of December 31, 2019, the latest date for which information is available to the Company. According to a Schedule 13G/A filed jointly by Levin Easterly Partners LLC (which identified itself as an investment adviser), LE Partners Holdings LLC, LE Partners Holdings II LLC, LE Partners Holdings III LLC, LE Partners Holdings IV LLC, John "Jack" Murphy, Darrell Crate, and Avshalom Kalichstein, shared dispositive power is held with respect all of such shares and shared voting power is held with respect to 4,065,867 shares. Levin Easterly's address is 595 Madison Avenue, 17th Floor, New York, NY 10022.

(6) Information is as of December 31, 2019, the latest date for which information is available to the Company. According to a Schedule 13G filed by The Vanguard Group, which identified itself as an investment adviser, sole voting power is held with respect to 147,604 shares, shared voting power is held with respect to 5,387 shares, sole dispositive power is held with respect to 4,264,839 shares, and shared dispositive power is held with respect to 144,937 shares. Vanguard's address is 100 Vanguard Blvd., Malvern, PA 19355.

(7) Consists of 196,593 shares held by Stephen Christopher Linthwaite, options to purchase 402,253 shares of common stock that are exercisable within 60 days of May 1, 2020, and 19,444 RSUs scheduled to vest within 60 days of May 1, 2020.

(8) Consists of 136,436 shares held by the Barthelemy 2001 Trust, of which Mr. Barthelemy is a trustee, options to purchase 36,646 shares of common stock that are exercisable within 60 days of May 1, 2020, and 7,804 RSUs that are scheduled to vest within 60 days of May 1, 2020.

(9) Consists of 8,000 shares held by Gerhard F. Burbach, options to purchase 92,396 shares of common stock that are exercisable within 60 days of May 1, 2020, and 30,215 RSUs that are vested or scheduled to vest within 60 days of May 1, 2020 and with respect to which Mr. Burbach has deferred settlement as described in "*Compensation of Directors - RSUs in Lieu of Cash and RSU Deferral*."

(10) Consists of options to purchase 10,546 shares of common stock that are exercisable within 60 days of May 1, 2020, and 6,487 RSUs that are vested or scheduled to vest within 60 days of May 1, 2020 with respect to which Ms. Clague has deferred settlement as described in "*Compensation of Directors - RSUs in Lieu of Cash and RSU Deferral*."

(11) Consists of 140,901 shares held by Samuel D. Colella, 5,561 shares held by The Colella Family Partners, L.P., of which Mr. Colella is the general partner, 69,272 shares held by the Colella Family Exempt Marital Deduction Trust dated 9/21/1992 of which Mr. Colella is a trustee, 3,326 shares held by the Colella Family Non-Exempt Marital Deduction Trust dated 9/21/1992 of which Mr. Colella is a trustee, options to purchase 26,796 shares of common stock that are exercisable within 60 days of May 1, 2020, and 9,394 RSUs that are scheduled to vest within 60 days of May 1, 2020.

(12) Consists of 19,100 shares held by Patrick S. Jones, options to purchase 116,396 shares of common stock that are exercisable within 60 days of May 1, 2020, and 3,987 RSUs that are scheduled to vest within 60 days of May 1, 2020.

(13) Consists of 39,356 shares held by Carlos V. Paya, options to purchase 36,646 shares of common stock that are exercisable within 60 days of May 1, 2020, and 3,987 RSUs that are scheduled to vest within 60 days of May 1, 2020.

(14) Consists of 52,762 shares held by Vikram Jog, 52,061 shares held by the Vikram and Pratima Jog Family Trust U/A dated June 23, 2009, of which Mr. Jog is a trustee, options to purchase 109,766 shares of common stock that are exercisable within 60 days of May 1, 2020, and 6,650 RSUs scheduled to vest within 60 days of May 1, 2020.

(15) Consists of 50,668 shares held by Nicholas Khadder and options to purchase 65,786 shares of common stock that are exercisable within 60 days of May 1, 2020.

(16) Consists of 19,401 shares held by Bradley Kreger, options to purchase 54,174 shares of common stock that are exercisable within 60 days of May 1, 2020, and 5,361 RSUs scheduled to vest within 60 days of May 1, 2020.

(17) Consists of 5,507 shares held by Colin McCracken and 16,516 RSUs scheduled to vest within 60 days of May 1, 2020.

(18) Consists of 798,944 shares beneficially owned by current directors and NEOs, options held by current directors and NEOs to purchase 951,405 shares of common stock that are exercisable within 60 days of May 1, 2020, 81,117 RSUs held by current directors and executive officers that are scheduled to vest within 60 days of May 1, 2020, and 32,715 vested RSUs with respect to which settlement has been deferred.

OTHER MATTERS

We know of no other matters to be submitted at the 2020 Annual Meeting. If any other matters properly come before the 2020 Annual Meeting, it is the intention of the persons named in the proxy to vote the shares they represent as the Board may recommend. Discretionary authority with respect to such other matters is granted by a properly submitted proxy.

It is important that your shares be represented at the 2020 Annual Meeting, regardless of the number of shares that you hold. You are, therefore, urged to vote as promptly as possible to ensure your vote is recorded.

THE BOARD OF DIRECTORS

South San Francisco, California
May 14, 2020

Exhibit I

FLUIDIGM CORPORATION

AMENDED AND RESTATED
2017 EMPLOYEE STOCK PURCHASE PLAN

(As amended and restated effective upon stockholder approval at the 2020 Annual Meeting of Stockholders)

1. Purpose. The purpose of the Plan is to provide employees of the Company and its Designated Subsidiaries with an opportunity to purchase Common Stock through accumulated Contributions. This Plan includes two components: a Code Section 423 Plan Component and a Non-423 Plan Component. The Company's intention is to have the Code Section 423 Plan Component qualify as an "employee stock purchase plan" under Section 423 of the Code and the provisions of the Plan with respect to the Code Section 423 Component, accordingly, will be construed so as to extend and limit Plan participation in a uniform and nondiscriminatory basis consistent with the requirements of Section 423 of the Code. In addition, this Plan authorizes the grant of options under the Non-423 Plan Component that do not qualify under Section 423 of the Code, pursuant to rules, procedures or sub-plans adopted by the Administrator that are designed to achieve tax, securities laws or other objectives for Eligible Employees and/or the Company. Except as otherwise indicated, the Non-423 Plan Component will operate and be administered in the same manner as the Code Section 423 Plan Component.

2. Definitions.

(a) "Administrator" means the Board or any Committee designated by the Board to administer the Plan pursuant to Section 14.

(b) "Applicable Laws" means the requirements relating to the administration of equity-based awards under U.S. state corporate laws, U.S. federal and state securities laws, the Code, any stock exchange or quotation system on which the Common Stock is listed or quoted and the applicable laws of any foreign country or jurisdiction where the Plan is, or will be, offered.

(c) "Board" means the Board of Directors of the Company.

(d) "Change in Control" means the occurrence of any of the following events:

(i) A change in the ownership of the Company which occurs on the date that any one person, or more than one person acting as a group ("Person"), acquires ownership of the stock of the Company that, together with the stock held by such Person, constitutes more than fifty percent (50%) of the total voting power of the stock of the Company; provided, however, that for purposes of this subsection, the acquisition of additional stock by any one Person, who is considered to own more than fifty percent (50%) of the total voting power of the stock of the Company will not be considered a Change in Control; or

(ii) A change in the effective control of the Company which occurs on the date that a majority of members of the Board is replaced during any twelve (12) month period by Directors whose appointment or election is not endorsed by a majority of the members of the Board prior to the date of the appointment or election. For purposes of this clause (ii), if any Person is considered to be in effective control of the Company, the acquisition of additional control of the Company by the same Person will not be considered a Change in Control; or

(iii) A change in the ownership of a substantial portion of the Company's assets which occurs on the date that any Person acquires (or has acquired during the twelve (12) month period ending on the date of the most recent acquisition by such person or persons) assets from the Company that have a total gross fair market value equal to or more than fifty percent (50%) of the total gross fair market value of all of the assets of the Company immediately prior to such acquisition or acquisitions; provided, however, that for purposes of this subsection, the following will not constitute a change in the ownership of a substantial portion of the Company's assets: (A) a transfer to an entity that is controlled by the Company's stockholders immediately after the transfer, or (B) a transfer of assets by the Company to: (1) a stockholder of the Company (immediately before the asset transfer) in exchange for or with respect to the Company's stock, (2) an entity, fifty percent (50%) or more of the total value or voting power of which is owned, directly or indirectly, by the Company, (3) a Person, that owns, directly or indirectly, fifty percent (50%) or more of the total value or voting power of all the outstanding stock of the Company, or (4) an entity, at least fifty percent (50%) of the total value or voting power of which is owned, directly or indirectly, by a Person described in this subsection (iii)(B)(3). For purposes of this subsection, gross fair market value means the value of the assets of the Company, or the value of the assets being disposed of, determined without regard to any liabilities associated with such assets.

For purposes of this definition, persons will be considered to be acting as a group if they are owners of a corporation that enters into a merger, consolidation, purchase or acquisition of stock, or similar business transaction with the Company.

Notwithstanding the foregoing, a transaction will not be deemed a Change in Control unless the transaction qualifies as a change in control event within the meaning of Code Section 409A, as it has been and may be amended from time to time, and any proposed or final U.S. Treasury Regulations and Internal Revenue Service guidance that has been promulgated or may be promulgated thereunder from time to time.

Further and for the avoidance of doubt, a transaction will not constitute a Change in Control if: (i) its sole purpose is to change the state of the Company's incorporation, or (ii) its sole purpose is to create a holding company that will be owned in substantially the same proportions by the persons who held the Company's securities immediately before such transaction.

(e) "Code" means the U.S. Internal Revenue Code of 1986, as amended. Reference to a specific section of the Code or U.S. Treasury Regulation thereunder will include such section or regulation, any valid regulation or other official applicable guidance promulgated under such section, and any comparable provision of any future legislation or regulation amending, supplementing or superseding such section or regulation.

(f) "Code Section 423 Plan Component" means the component of this Plan that is intended to meet the requirements set forth in Section 423(b) of the Code. The Code Section 423 Plan Component shall be construed, administered and enforced in accordance with Section 423(b) of the Code.

(g) "Committee" means a committee of the Board appointed in accordance with Section 14 hereof.

(h) "Common Stock" means the common stock of the Company.

(i) "Company" means Fluidigm Corporation, a Delaware corporation, or any successor thereto.

(j) "Compensation" means an Eligible Employee's base straight time gross earnings, payments for overtime and shift premium, but exclusive of payments for incentive compensation, commissions, bonuses and other similar compensation. The Administrator shall have the discretion to determine what constitutes Compensation for participants under the Plan with respect to future Offerings, but for purposes of participants participating in the Code Section 423 Plan Component, it will be applied on a uniform, non-discriminatory basis.

(k) "Contributions" means the payroll deductions and other additional payments that the Company may permit to be made by a Participant to fund the exercise of options granted pursuant to the Plan.

(l) "Designated Subsidiary" means any Subsidiary that has been designated by the Administrator from time to time in its sole discretion as eligible to participate in the Plan. The Administrator may provide that any Designated Subsidiary shall only be eligible to participate in the Non- 423 Plan Component and at any given time, a Subsidiary that is a Designated Subsidiary under the Code Section 423 Plan Component shall not be a Designated Subsidiary under the Non-423 Plan Component.

(m) "Director" means a member of the Board.

(n) "Eligible Employee" means any individual who is a common law employee of an Employer. For purposes of the Plan, the employment relationship will be treated as continuing intact while the individual is on sick leave or other leave of absence that the Employer approves or is legally protected under Applicable Laws. Where the period of leave exceeds three (3) months and the individual's right to reemployment is not guaranteed either by statute or by contract, the employment relationship will be deemed to have terminated three (3) months and one (1) day following the commencement of such leave. The Administrator, in its discretion, from time to time may, prior to an Offering Date for all options to be granted on such Offering Date in an Offering, determine (and for purposes of the Code Section 423 Plan Component, on a uniform and nondiscriminatory basis or as otherwise permitted by Treasury Regulation Section 1.423-2) that the definition of Eligible Employee will or will not include an individual if he or she: (i) customarily works not more than twenty (20) hours per week. (ii) is a highly compensated employee within the meaning of Section 414(q) of the Code, or (iii) is a highly compensated employee within the meaning of Section 414(q) of the Code with compensation above a certain level or is an officer or subject to the disclosure requirements of Section 16(a) of the Exchange Act, provided the exclusion is applied with respect to each Offering in an identical manner to all highly compensated individuals of the Employer whose Employees are participating in that Offering. Each exclusion shall be applied with respect to an Offering in a manner complying with U.S. Treasury Regulation Section 1.423-2(e)(2)(ii). For Offerings under the Non-423 Plan Component, Eligible Employee will also mean any other employee of an Employer to the extent that Applicable Law requires participation in the Plan to be extended to such employee, as determined by the Administrator.

(o) "Employer" means the employer of the applicable Eligible Employee(s).

(p) "Exchange Act" means the Securities Exchange Act of 1934, as amended, including the rules and regulations promulgated thereunder.

(q) "Exercise Date" means the last Trading Day on or before May 31 and November 30 of each Purchase Period.

(r) "Fair Market Value" means, as of any date and unless the Administrator determines otherwise, the value of Common Stock determined as follows:

(i) If the Common Stock is listed on any established stock exchange or a national market system, including without limitation the Nasdaq Global Select Market, the Nasdaq Global Market or the Nasdaq Capital Market of The Nasdaq Stock Market, its Fair Market Value will be the closing sales price for such stock (or the closing bid, if no sales were reported) as quoted on such exchange or system on the date of determination, as reported in *The Wall Street Journal* or such other source as the Administrator deems reliable;

(ii) If the Common Stock is regularly quoted by a recognized securities dealer but selling prices are not reported, its Fair Market Value will be the mean between the high bid and low asked prices for the Common Stock on the date of determination (or if no bids and asks were reported on that date, as applicable, on the last Trading Day such bids and asks were reported), as reported in *The Wall Street Journal* or such other source as the Administrator deems reliable; or

(iii) In the absence of an established market for the Common Stock, the Fair Market Value thereof will be determined in good faith by the Administrator.

(s) "New Exercise Date" means a new Exercise Date set by shortening any Offering Period then in progress.

(t) "Non-423 Plan Component" means a component of this Plan that is not intended to meet the requirements set forth in Section 423(b) of the Code.

(u) "Offering" means an offer under the Plan of an option that may be exercised during an Offering Period as further described in Section 4. For purposes of the Plan, the Administrator may designate separate Offerings under the Plan (the terms of which need not be identical) in which Employees of one or more Employers will participate, even if the dates of the applicable Offering Periods of each such Offering are identical and the provisions of the Plan will separately apply to each Offering. To the extent permitted by U.S. Treasury Regulation Section 1.423-2(a)(1), the terms of each Offering need not be identical provided that the terms of the Plan and an Offering together satisfy U.S. Treasury Regulation Section 1.423-2(a)(2) and (a)(3).

(v) "Offering Date" means the first Trading Day of each Offering Period.

(w) "Offering Periods" means the periods of approximately six (6) months during which an option granted pursuant to the Plan may be exercised, (i) commencing on the first Trading Day on or after May 31 and November 30 of each year and terminating on the first Trading Day on or after May 31 and November 30, approximately six (6) months later. The duration and timing of Offering Periods may be changed pursuant to Sections 4 and 20.

(x) "Parent" means a "parent corporation," whether now or hereafter existing, as defined in Section 424(e) of the Code.

(y) "Participant" means an Eligible Employee who participates in the Plan.

(z) "Plan" means this Fluidigm Corporation 2017 Employee Stock Purchase Plan.

(aa) "Purchase Period" means the period(s) of an Offering Period during which shares of Common Stock may be purchased on a Participant's behalf in accordance with the terms of the Plan. Unless the Administrator provides otherwise, the Purchase Period will have the same duration and coincide with the length of the Offering Period.

(bb) "Purchase Price" means an amount equal to eighty-five percent (85%) of the Fair Market Value of a share of Common Stock on the Offering Date or on the Exercise Date, whichever is lower; provided however, that the Purchase Price may be determined for subsequent Offering Periods by the Administrator subject to compliance with Section 423 of the Code (or any successor rule or provision or any other applicable law, regulation or stock exchange rule) or pursuant to Section 20.

(cc) "Subsidiary" means a "subsidiary corporation," whether now or hereafter existing, as defined in Section 424(f) of the Code.

(dd) "Trading Day" means a day on which the national stock exchange upon which the Common Stock is listed is open for trading.

(ee) "U.S. Treasury Regulations" means the Treasury regulations of the Code. Reference to a specific Treasury Regulation or Section of the Code shall include such Treasury Regulation or Section, any valid regulation promulgated under such Section, and any comparable provision of any future legislation or regulation amending, supplementing or superseding such Section or regulation.

3. Eligibility.

(a) Offering Periods. Any Eligible Employee on a given Offering Date will be eligible to participate in the Plan, subject to the requirements of Section 5.

(b) Non-U.S. Employees. Eligible Employees who are citizens or residents of a non-U.S. jurisdiction (without regard to whether they also are citizens or residents of the United States or resident aliens (within the meaning of Section 7701(b)(1)(A) of the Code)) may be excluded from participation in the Plan or an Offering if the participation of such Eligible Employees is prohibited under the laws of the applicable jurisdiction or if complying with the laws of the applicable jurisdiction would cause the Plan or an Offering to violate Section 423 of the Code.

(c) Limitations. Any provisions of the Plan to the contrary notwithstanding, no Eligible Employee will be granted an option under the Plan (i) to the extent that, immediately after the grant, such Eligible Employee (or any other person whose stock would be attributed to such Eligible Employee pursuant to Section 424(d) of the Code) would own capital stock of the Company or any Parent or Subsidiary of the Company and/or hold outstanding options to purchase such stock possessing five percent (5%) or more of the total combined voting power or value of all classes of the capital stock of the Company or of any Parent or Subsidiary of the Company, or (ii) to the extent that his or her rights to purchase stock under all employee stock purchase plans (as defined in Section 423 of the Code) of the Company or any Parent or Subsidiary of the Company accrues at a rate, which exceeds twenty-five thousand dollars ($25,000) worth of stock (determined at the Fair Market Value of the stock at the time such option is granted) for each calendar year in which such option is outstanding at any time, as determined in accordance with Section 423 of the Code and the regulations thereunder.

4. Offering Periods. The Plan will be implemented by consecutive Offering Periods with a new Offering Period commencing on the first Trading Day on or after May 31 and November 30 each year, or on such other date as the Administrator will determine. The Administrator will have the power to change the duration of Offering Periods (including the commencement dates thereof) with respect to future Offerings without stockholder approval if such change is announced prior to the scheduled beginning of the first Offering Period to be affected thereafter.

5. Participation. An Eligible Employee may participate in the Plan pursuant to Section 3(a) by (i) submitting to the Company's stock administration office (or its designee), on or before a date determined by the Administrator prior to an applicable Offering Date, a properly completed subscription agreement authorizing Contributions in the form provided by the

Administrator for such purpose (which may be similar to the form attached to this Plan as Exhibit A), or (ii) following an electronic or other enrollment procedure determined by the Administrator.

6. Contributions.

(a) At the time a Participant enrolls in the Plan pursuant to Section 5, he or she will elect to have payroll deductions made on each pay day or other Contributions (to the extent permitted by the Administrator) made during the Offering Period in an amount not exceeding ten percent (10%) of the Compensation that he or she receives on each pay day during the Offering Period. A Participant's subscription agreement will remain in effect for successive Offering Periods unless terminated as provided in Section 10 hereof.

(b) Payroll deductions for a Participant will commence on the first pay day following the Offering Date and will end on the last pay day prior to the Exercise Date of such Offering Period to which such authorization is applicable, unless sooner terminated by the Participant as provided in Section 10 hereof.

(c) All Contributions made for a Participant will be credited to his or her account under the Plan and payroll deductions will be made in whole percentages only. A Participant may not make any additional payments into such account, unless required by Applicable Law.

(d) A Participant may discontinue his or her participation in the Plan as provided in Section 10. Unless otherwise determined by the Administrator, a Participant may not increase or decrease the rate of his or her Contributions during an Offering Period, except for a withdrawal in accordance with Section 10.

(e) Notwithstanding the foregoing, to the extent necessary to comply with Section 423(b)(8) of the Code and Section 3(b), a Participant's Contributions may be decreased to zero percent (0%) at any time during a Purchase Period. Subject to Section 423(b)(8) of the Code and Section 3(b) hereof, Contributions will recommence at the rate originally elected by the Participant effective as of the beginning of the first Purchase Period scheduled to end in the following calendar year, unless terminated by the Participant as provided in Section 10.

(f) At the time the option is exercised, in whole or in part, or at the time some or all of the Common Stock issued under the Plan is disposed of (or any other time that a taxable event related to the Plan occurs), the Participant must make adequate provision for the Company's or Employer's federal, state, local or any other tax liability payable to any authority including taxes imposed by jurisdictions outside of the U.S., national insurance, social insurance contributions, social security or other tax withholding obligations, if any, which arise upon the exercise of the option or the disposition of the Common Stock (or any other time that a taxable event related to the Plan occurs). At any time, the Company or the Employer may, but will not be obligated to, withhold from the Participant's compensation or other payments made to Participant the amount necessary for the Company or the Employer to meet applicable withholding obligations, including any withholding required to make available to the Company or the Employer any tax deductions or benefits attributable to sale or early disposition of Common Stock by the Eligible Employee. In addition, the Company or the Employer may, but will not be obligated to, withhold from the proceeds of the sale of Common Stock or any other method of withholding the Company or the Employer deems appropriate to the extent permitted by U.S. Treasury Regulation Section 1.423-2(f) for Offerings under the Code Section 423 Plan Component.

7. Grant of Option. On the Offering Date of each Offering Period, each Eligible Employee participating in such Offering Period will be granted an option to purchase on each Exercise Date during such Offering Period (at the applicable Purchase Price) up to a number of shares of Common Stock determined by dividing such Eligible Employee's Contributions accumulated prior to and including such Exercise Date and retained in the Eligible Employee's account as of the Exercise Date by the applicable Purchase Price; provided that in no event will an Eligible Employee be permitted to purchase during each Offering Period more than 5,000 shares of Common Stock (subject to any adjustment pursuant to Section 19) and provided further that such purchase will be subject to the limitations set forth in Sections 3(c) and 13. The Eligible Employee may accept the grant of such option by electing to participate in the Plan in accordance with the requirements of Section 5. The Administrator may, for future Offering Periods, increase or decrease, in its absolute discretion, the maximum number of shares of Common Stock that an Eligible Employee may purchase during each Purchase Period or Offering Period. Exercise of the option will occur as provided in Section 8, unless the Participant has withdrawn pursuant to Section 10. The option will expire on the last day of the Offering Period.

8. Exercise of Option.

(a) Unless a Participant withdraws from the Plan as provided in Section 10, his or her option for the purchase of shares of Common Stock will be exercised automatically on the Exercise Date, and the maximum number of full shares subject to the option will be purchased for such Participant at the applicable Purchase Price with the accumulated Contributions from his or her account. No fractional shares of Common Stock will be purchased; any Contributions accumulated in a Participant's account, which are not sufficient to purchase a full share will be returned to the Participant. Any other funds left over in a Participant's account after the Exercise Date will be returned to the Participant. During a Participant's lifetime, a Participant's option to purchase shares hereunder is exercisable only by the Participant.

(b) If the Administrator determines that, on a given Exercise Date, the number of shares of Common Stock with respect to which options are to be exercised may exceed (i) the number of shares of Common Stock that were available for sale under the Plan on the Offering Date of the applicable Offering Period, or (ii) the number of shares of Common Stock available for sale under the Plan on such Exercise Date, the Administrator may in its sole discretion provide that the Company will make a pro rata allocation of the shares of Common Stock available for purchase on such Offering Date or Exercise Date, as applicable, in as uniform a manner as will be practicable and as it will determine in its sole discretion to be equitable among all participants exercising options to purchase Common Stock on such Exercise Date, and continue all Offering Periods then in effect or terminate any or all Offering Periods then in effect pursuant to Section 20. The Company may make a pro rata allocation of the shares available on the Offering Date of any applicable Offering Period pursuant to the preceding sentence, notwithstanding any authorization of additional shares for issuance under the Plan by the Company's stockholders subsequent to such Offering Date.

9. Delivery. As soon as reasonably practicable after each Exercise Date on which a purchase of shares of Common Stock occurs, the Company will arrange the delivery to each Participant of the shares purchased upon exercise of his or her option in a form determined by the Administrator (in its sole discretion) and pursuant to rules established by the Administrator. The Company may permit or require that shares be deposited directly with a broker designated by the Company or to a designated agent of the Company, and the Company may utilize electronic or automated methods of share transfer. The Company may require that shares be retained with such broker or agent for a designated period of time and/or may establish other procedures to permit tracking of disqualifying dispositions of such shares. No Participant will have any voting, dividend, or other stockholder rights with respect to shares of Common Stock subject to any option granted under the Plan until such shares have been purchased and delivered to the Participant as provided in this Section 9.

10. Withdrawal.

(a) A Participant may withdraw all but not less than all the Contributions credited to his or her account and not yet used to exercise his or her option under the Plan at any time by (i) submitting to the Company's stock administration office (or its designee) a written notice of withdrawal in the form determined by the Administrator for such purpose (which may be similar to the form attached to this Plan as Exhibit B), or (ii) following an electronic or other withdrawal procedure determined by the Administrator, in each case, at least 10 days prior to the Exercise Date (the "Withdrawal Deadline"). If a withdrawal under this Section 10(a) is not timely made prior to the Withdrawal Deadline, then the Participant's option for the Offering Period will continue to be exercised on an Exercise Date. All of the Participant's Contributions credited to his or her account will be paid to such Participant promptly after receipt of notice of withdrawal and such Participant's option for the Offering Period will be automatically terminated, and no further Contributions for the purchase of shares will be made for such Offering Period. If a Participant withdraws from an Offering Period, Contributions will not resume at the beginning of the succeeding Offering Period, unless the Participant re-enrolls in the Plan in accordance with the provisions of Section 5.

(b) A Participant's withdrawal from an Offering Period will not have any effect upon his or her eligibility to participate in any similar plan that may hereafter be adopted by the Company or in succeeding Offering Periods that commence after the termination of the Offering Period from which the Participant withdraws.

11. Termination of Employment. Upon a Participant's ceasing to be an Eligible Employee, for any reason, he or she will be deemed to have elected to withdraw from the Plan and the Contributions credited to such Participant's account during the Offering Period but not yet used to purchase shares of Common Stock under the Plan will be returned to such Participant or, in the case of his or her death, to the person or persons entitled thereto under Section 15, and such Participant's option will be automatically terminated.

12. Interest. No interest will accrue on Contributions of a Participant in the Plan, except as may be required by Applicable Law, as determined by the Company, for Participants in the Non-423 Plan Component (or the Code Section 423 Plan Component if permitted under Section 423 of the Code).

13. Stock.

(a) Subject to adjustment upon changes in capitalization of the Company as provided in Section 19 hereof, the maximum number of shares of Common Stock that will be made available for sale under the Plan will be 4,000,000 shares of Common Stock.

(b) Until the shares are issued (as evidenced by the appropriate entry on the books of the Company or of a duly authorized transfer agent of the Company), a Participant will only have the rights of an unsecured creditor with respect to such shares, and no right to vote or receive dividends or any other rights as a stockholder will exist with respect to such shares.

(c) Shares of Common Stock to be delivered to a Participant under the Plan will be registered in the name of the Participant or in the name of the Participant and his or her spouse.

14. Administration. The Plan will be administered by the Board or a Committee appointed by the Board, which Committee will be constituted to comply with Applicable Laws. The Administrator will have full and exclusive discretionary authority to construe, interpret and apply the terms of the Plan, to designate separate Offerings under the Plan, to determine eligibility, to adjudicate all disputed claims filed under the Plan and to establish such procedures that it deems necessary for the administration of the Plan (including, without limitation, to adopt such procedures and sub-plans as are necessary or appropriate to permit the participation in the Plan by employees who are foreign nationals or employed outside the U.S., the terms of which sub-plans may take precedence over other provisions of this Plan, with the exception of Section 13(a) hereof, but unless otherwise superseded by the terms of such sub-plan, the provisions of this Plan shall govern the operation of such sub-plan). Unless otherwise determined by the Administrator, the Employees eligible to participate in each sub-plan will participate in a separate Offering. Without limiting the generality of the foregoing, the Administrator is specifically authorized to adopt rules and procedures regarding eligibility to participate, the definition of Compensation, handling of Contributions, making of Contributions to the Plan (including, without limitation, in forms other than payroll deductions), establishment of bank or trust accounts to hold Contributions, payment of interest, conversion of local currency, obligations to pay payroll tax, determination of beneficiary designation requirements, withholding procedures and handling of stock certificates that vary with applicable local requirements. The Administrator also is authorized to determine that, to the extent permitted by U.S. Treasury Regulation Section 1.423-2(f), the terms of an option granted under the Plan or an Offering to citizens or residents of a non-U.S. jurisdiction will be less favorable than the terms of options granted under the Plan or the same Offering to employees resident solely in the U.S. Every finding, decision and determination made by the Administrator will, to the full extent permitted by law, be final and binding upon all parties.

15. Designation of Beneficiary.

(a) If permitted by the Administrator, a Participant may file a designation of a beneficiary who is to receive any shares of Common Stock and cash, if any, from the Participant's account under the Plan in the event of such Participant's death subsequent to an Exercise Date on which the option is exercised but prior to delivery to such Participant of such shares and cash. In addition, if permitted by the Administrator, a Participant may file a designation of a beneficiary who is to receive any cash from the Participant's account under the Plan in the event of such Participant's death prior to exercise of the option. If a Participant is married and the designated beneficiary is not the spouse, spousal consent will be required for such designation to be effective.

(b) Such designation of beneficiary may be changed by the Participant at any time by notice in a form determined by the Administrator. In the event of the death of a Participant and in the absence of a beneficiary validly designated under the Plan who is living at the time of such Participant's death, the Company will deliver such shares and/or cash to the executor or administrator of the estate of the Participant, or if no such executor or administrator has been appointed (to the knowledge of the Company), the Company, in its discretion, may deliver such shares and/or cash to the spouse or to any one or more dependents or relatives of the Participant, or if no spouse, dependent or relative is known to the Company, then to such other person as the Company may designate.

(c) The Administrator may determine whether Participants may designate beneficiaries under the Plan. Notwithstanding Sections 15(a) and (b) above, the Company and/or the Administrator may decide not to permit such designations by Participants pursuant to Offerings under the Non-423 Plan Component, and for Offerings under the Code Section 423 Plan Component in non-U.S. jurisdictions to the extent permitted by U.S. Treasury Regulation Section 1.423-2(f). All beneficiary designations will be in such form and manner as the Administrator may designate from time to time.

16. Transferability. Neither Contributions credited to a Participant's account nor any rights with regard to the exercise of an option or to receive shares of Common Stock under the Plan may be assigned, transferred, pledged or otherwise disposed of in any way (other than by will, the laws of descent and distribution or as provided in Section 15 hereof) by the Participant. Any such attempt at assignment, transfer, pledge or other disposition will be without effect, except that the Company may treat such act as an election to withdraw funds from an Offering Period in accordance with Section 10 hereof.

17. Use of Funds. The Company may use all Contributions received or held by it under the Plan for any corporate purpose, and the Company will not be obligated to segregate such Contributions, unless otherwise required by Applicable Laws, as determined by the Administrator. Until shares of Common Stock are issued, Participants will only have the rights of an unsecured creditor with respect to such shares.

18. Reports. Individual accounts will be maintained for each Participant in the Plan. Statements of account will be given to participating Eligible Employees at least annually, which statements will set forth the amounts of Contributions, the Purchase Price, the number of shares of Common Stock purchased and the remaining cash balance, if any.

19. Adjustments, Dissolution, Liquidation, Merger or Change in Control.

(a) Adjustments. In the event that any dividend or other distribution (whether in the form of cash, Common Stock, other securities, or other property), recapitalization, stock split, reverse stock split, reorganization, merger, consolidation, split-up, spin-off, combination, repurchase, or exchange of Common Stock or other securities of the Company, or other change in the corporate structure of the Company affecting the Common Stock occurs, the Administrator, in order to prevent dilution or enlargement of the benefits or potential benefits intended to be made available under the Plan, will, in such manner as it may deem equitable, adjust the number and class of Common Stock that may be delivered under the Plan, the Purchase Price per share and the number of shares of Common Stock covered by each option under the Plan that has not yet been exercised, and the numerical limits of Sections 7 and 13.

(b) Dissolution or Liquidation. In the event of the proposed dissolution or liquidation of the Company, any Offering Period then in progress will be shortened by setting a New Exercise Date, and will terminate immediately prior to the consummation of such proposed dissolution or liquidation, unless provided otherwise by the Administrator. The New Exercise Date will be before the date of the Company's proposed dissolution or liquidation. The Administrator will notify each Participant in writing or electronically, prior to the New Exercise Date, that the Exercise Date for the Participant's option has been changed to the New Exercise Date and that the Participant's option will be exercised automatically on the New Exercise Date, unless prior to such date the Participant has withdrawn from the Offering Period as provided in Section 10 hereof.

(c) Merger or Change in Control. In the event of a merger or Change in Control, each outstanding option will be assumed or an equivalent option substituted by the successor corporation or a Parent or Subsidiary of the successor corporation. In the event that the successor corporation refuses to assume or substitute for the option, the Offering Period with respect to which such option relates will be shortened by setting a New Exercise Date on which such Offering Period shall end. The New Exercise Date will occur before the date of the Company's proposed merger or Change in Control. The Administrator will notify each Participant in writing or electronically prior to the New Exercise Date, that the Exercise Date for the Participant's option has been changed to the New Exercise Date and that the Participant's option will be exercised automatically on the New Exercise Date, unless prior to such date the Participant has withdrawn from the Offering Period as provided in Section 10 hereof.

20. Amendment or Termination.

(a) The Administrator, in its sole discretion, may amend, suspend, or terminate the Plan, or any part thereof, at any time and for any reason. If the Plan is terminated, the Administrator, in its discretion, may elect to terminate all outstanding Offering Periods either immediately or upon completion of the purchase of shares of Common Stock on the next Exercise Date (which may be sooner than originally scheduled, if determined by the Administrator in its discretion), or may elect to permit Offering Periods to expire in accordance with their terms (and subject to any adjustment pursuant to Section 19). If the Offering Periods are terminated prior to expiration, all amounts then credited to Participants' accounts that have not been used to purchase shares of Common Stock will be returned to the Participants (without interest thereon, , except as otherwise required by Applicable Laws) as soon as administratively practicable.

(b) Without stockholder consent and without limiting Section 20(a), the Administrator will be entitled to change the Offering Periods or Purchase Periods, designate separate Offerings, limit the frequency and/or number of changes in the amount withheld during an Offering Period, establish the exchange ratio applicable to amounts withheld in a currency other than U.S. dollars, permit payroll withholding in excess of the amount designated by a Participant in order to adjust for delays or mistakes in the Company's processing of properly completed withholding elections, establish reasonable waiting and adjustment periods and/or accounting and crediting procedures to ensure that amounts applied toward the purchase of Common Stock for each Participant properly correspond with Contribution amounts, and establish such other limitations or procedures as the Administrator determines in its sole discretion advisable that are consistent with the Plan.

(c) In the event the Administrator determines that the ongoing operation of the Plan may result in unfavorable financial accounting consequences, the Administrator may, in its discretion and, to the extent necessary or desirable, modify, amend or terminate the Plan to reduce or eliminate such accounting consequence including, but not limited to:

(i) amending the Plan to conform with the safe harbor definition under the Financial Accounting Standards Board Accounting Standards Codification Topic 718 (or any successor thereto), including with respect to an Offering Period underway at the time;

(ii) altering the Purchase Price for any Offering Period or Purchase Period including an Offering Period or Purchase Period underway at the time of the change in Purchase Price;

(iii) shortening any Offering Period or Purchase Period by setting a New Exercise Date, including an Offering Period or Purchase Period underway at the time of the Administrator action;

(iv) reducing the maximum percentage of Compensation a Participant may elect to set aside as Contributions; and

(v) reducing the maximum number of Shares a Participant may purchase during any Offering Period or Purchase Period.

Such modifications or amendments will not require stockholder approval or the consent of any Plan Participants.

21. Notices. All notices or other communications by a Participant to the Company under or in connection with the Plan will be deemed to have been duly given when received in the form and manner specified by the Company at the location, or by the person, designated by the Company for the receipt thereof.

22. Conditions Upon Issuance of Shares. Shares of Common Stock will not be issued with respect to an option unless the exercise of such option and the issuance and delivery of such shares pursuant thereto will comply with all applicable provisions of law, domestic or foreign, including, without limitation, the Securities Act of 1933, as amended, the Exchange Act, the rules and regulations promulgated thereunder, and the requirements of any stock exchange upon which the shares may then be listed, and will be further subject to the approval of counsel for the Company with respect to such compliance.

As a condition to the exercise of an option, the Company may require the person exercising such option to represent and warrant at the time of any such exercise that the shares are being purchased only for investment and without any present intention to sell or distribute such shares if, in the opinion of counsel for the Company, such a representation is required by any of the aforementioned applicable provisions of law.

23. Code Section 409A. The Code Section 423 Plan Component is exempt from the application of Code Section 409A. The Non-423 Plan Component is intended to be exempt from Code Section 409A under the short-term deferral exception and any ambiguities herein will be interpreted to so be exempt from Code Section 409A. In furtherance of the foregoing and notwithstanding any provision in the Plan to the contrary, if the Administrator determines that an option granted under the Plan may be subject to Code Section 409A or that any provision in the Plan would cause an option under the Plan to be subject to Code Section 409A, the Administrator may amend the terms of the Plan and/or of an outstanding option granted under the Plan, or take such other action the Administrator determines is necessary or appropriate, in each case, without the Participant's consent, to exempt any outstanding option or future option that may be granted under the Plan from or to allow any such options to comply with Code Section 409A, but only to the extent any such amendments or action by the Administrator would not violate Code Section 409A. Notwithstanding the foregoing, the Company shall have no liability to a Participant or any other party if the option to purchase Common Stock under the Plan that is intended to be exempt from or compliant with Code Section 409A is not so exempt or compliant or for any action taken by the Administrator with respect thereto. The Company makes no representation that the option to purchase Common Stock under the Plan is compliant with Code Section 409A.

24. Term of Plan. The Plan will become effective upon its adoption by the Board or its approval by the stockholders of the Company. It will continue in effect until terminated under Section 20.

25. Stockholder Approval. The Plan will be subject to approval by the stockholders of the Company within twelve (12) months after the date the Plan is adopted by the Board. Such stockholder approval will be obtained in the manner and to the degree required under Applicable Laws.

26. Governing Law; Severability. The Plan and all determinations made and actions taken thereunder shall be governed by the internal substantive laws, and not the choice of law rules, of the State of California, United States and construed accordingly, to the extent not superseded by applicable U.S. federal law. If any provision of the Plan shall be held unlawful or otherwise invalid or unenforceable in whole or in part, the unlawfulness, invalidity or unenforceability shall not affect any other provision of the Plan or part thereof, each of which shall remain in full force and effect.

27. No Right to Employment or Services. Nothing in the Plan or any subscription agreement shall interfere with or limit in any way the right of the Employer to terminate any Participant's employment at any time, provided in compliance with applicable laws, nor confer upon any Participant any right to continue in the employ of the Employer.

<u>EXHIBIT A</u>

FLUIDIGM CORPORATION

2017 EMPLOYEE STOCK PURCHASE PLAN

SUBSCRIPTION AGREEMENT

Offering Date:

1. I, ___________________________, hereby elect to participate in the Fluidigm Corporation 2017 Employee Stock Purchase Plan (the "Plan") and subscribe to purchase shares of the Company's Common Stock in accordance with this Subscription Agreement and the Plan.

2. I hereby authorize payroll deductions from each paycheck in the amount of ____% of my Compensation on each payday (from 0 to 10%) during the Offering Period in accordance with the Plan. (Please note that no fractional percentages are permitted.)

3. I understand that said payroll deductions will be accumulated for the purchase of shares of Common Stock at the applicable Purchase Price determined in accordance with the Plan. I understand that if I do not withdraw from an Offering Period, any accumulated payroll deductions will be used to automatically exercise my option and purchase Common Stock under the Plan.

4. I have received a copy of the complete Plan and its accompanying prospectus. I understand that my participation in the Plan is in all respects subject to the terms of the Plan.

5. Shares of Common Stock purchased for me under the Plan should be issued in the name(s) of _______________ (Eligible Employee or Eligible Employee and Spouse only).

6. I understand that if I dispose of any shares received by me pursuant to the Plan within two (2) years after the Offering Date (the first day of the Offering Period during which I purchased such shares) or one (1) year after the Exercise Date, I will be treated for federal income tax purposes as having received ordinary income at the time of such disposition in an amount equal to the excess of the fair market value of the shares at the time such shares were purchased by me over the price that I paid for the shares. **I hereby agree to notify the Company in writing within thirty (30) days after the date of any disposition of my shares and I will make adequate provision for Federal, state or other tax withholding obligations, if any, which arise upon the disposition of the Common Stock.** The Company may, but will not be obligated to, withhold from my compensation the amount necessary to meet any applicable withholding obligation including any withholding necessary to make available to the Company any tax deductions or benefits attributable to sale or early disposition of Common Stock by me. If I dispose of such shares at any time after the expiration of the two (2)-year and one (1)-year holding periods, I understand that I will be treated for federal income tax purposes as having received income only at the time of such disposition, and that such income will be taxed as ordinary income only to the extent of an amount equal to the lesser of (a) the excess of the fair market value of the shares at the time of such disposition over the purchase price which I paid for the shares, or (b) 15% of the fair market value of the shares on the first day of the Offering Period. The remainder of the gain, if any, recognized on such disposition will be taxed as capital gain.

7. I hereby agree to be bound by the terms of the Plan. The effectiveness of this Subscription Agreement is dependent upon my eligibility to participate in the Plan.

Employee's Social Security Number:

Employee's Address: ____________________________________

____

I UNDERSTAND THAT THIS SUBSCRIPTION AGREEMENT WILL REMAIN IN EFFECT THROUGHOUT SUCCESSIVE OFFERING PERIODS UNLESS TERMINATED BY ME.

Dated: ______________________________________

Signature of Employee

EXHIBIT B

FLUIDIGM CORPORATION

2017 EMPLOYEE STOCK PURCHASE PLAN

NOTICE OF WITHDRAWAL

The undersigned participant in the Offering Period of the Fluidigm Corporation 2017 Employee Stock Purchase Plan that began on ____________, ________ (the "Enrollment Date") hereby notifies the Company that he or she hereby withdraws from the Offering Period. He or she hereby directs the Company to pay to the undersigned as promptly as practicable all the payroll deductions credited to his or her account with respect to such Offering Period. The undersigned understands and agrees that his or her option for such Offering Period will be automatically terminated. The undersigned understands further that no further payroll deductions will be made for the purchase of shares in the current Offering Period and the undersigned will be eligible to participate in succeeding Offering Periods only by delivering to the Company a new Subscription Agreement.

Name and Address of Participant:

____

____

____

Signature:

Date:

Exhibit II

FLUIDIGM CORPORATION

2011 EQUITY INCENTIVE PLAN

(as amended and restated effective June 3, 2019,
and as further amended, subject to, and contingent upon, stockholder approval
at the 2020 Annual Meeting of Stockholders)

1. Purposes of the Plan. The purposes of this Plan are (a) to attract and retain the best available personnel for positions of substantial responsibility, (b) to provide additional incentive to Employees, Directors and Consultants, and (c) to promote the success of the Company's business. The Plan permits the grant of Incentive Stock Options, Nonstatutory Stock Options, Restricted Stock, Restricted Stock Units, Stock Appreciation Rights, Performance Units and Performance Shares.

2. Definitions. As used herein, the following definitions will apply:

(a) "Administrator" means the Board or any of its Committees as may administer the Plan in accordance with Section 4 hereof.

(b) "Amendment Effective Date" means the date of the Company's 2020 Annual Meeting of Stockholders.

(c) "Applicable Laws" means the requirements relating to the administration of equity-based awards under U.S. state corporate laws, U.S. federal and state securities laws, the Code, any stock exchange or quotation system on which the Common Stock is listed or quoted and the applicable laws of any foreign country or jurisdiction where Awards are, or will be, granted under the Plan.

(d) "Award" means, individually or collectively, a grant under the Plan of Options, Stock Appreciation Rights, Restricted Stock, Restricted Stock Units, Performance Units or Performance Shares.

(e) "Award Agreement" means the written or electronic agreement setting forth the terms and provisions applicable to each Award granted under the Plan. The Award Agreement is subject to the terms and conditions of the Plan.

(f) "Board" means the Board of Directors of the Company.

(g) "Change in Control" means the occurrence of any of the following events:

(i) A change in the ownership of the Company which occurs on the date that any one person, or more than one person acting as a group ("Person"), acquires ownership of the stock of the Company that, together with the stock held by such Person, constitutes more than 50% of the total voting power of the stock of the Company; provided, however, that for purposes of this subsection (i), the acquisition of additional stock by any one Person, who is considered to own more than 50% of the total voting power of the stock of the Company will not be considered a Change in Control; or

(ii) A change in the effective control of the Company which occurs on the date that a majority of members of the Board is replaced during any twelve (12) month period by Directors whose appointment or election is not endorsed by a majority of the members of the Board prior to the date of the appointment or election. For purposes of this clause (ii), if any Person is considered to be in effective control of the Company, the acquisition of additional control of the Company by the same Person will not be considered a Change in Control; or

(iii) A change in the ownership of a substantial portion of the Company's assets which occurs on the date that any Person acquires (or has acquired during the twelve (12) month period ending on the date of the most recent acquisition by such person or persons) assets from the Company that have a total gross fair market value equal to or more than 50% of the total gross fair market value of all of the assets of the Company immediately prior to such acquisition or acquisitions; provided, however, that for purposes of this subsection (iii), the following will not constitute a change in the ownership of a substantial portion of the Company's assets: (A) a transfer to an entity that is controlled by the Company's stockholders immediately after the transfer, or (B) a transfer of assets by the Company to: (1) a stockholder of the Company (immediately before the asset transfer) in exchange for or with respect to the Company's stock, (2) an entity, 50% or more of the total value or voting power of which is owned, directly or indirectly, by the Company, (3) a Person, that owns, directly or indirectly, 50% or more of the total value or voting power of all the outstanding stock of the Company, or (4) an entity, at least 50% of the total value or voting power of which is owned, directly or indirectly, by a Person described in this subsection (iii)(B)(3). For purposes of this subsection (iii), gross fair market value means the value of the assets of the Company, or the value of the assets being disposed of, determined without regard to any liabilities associated with such assets.

For purposes of this definition, persons will be considered to be acting as a group if they are owners of a corporation that enters into a merger, consolidation, purchase or acquisition of stock, or similar business transaction with the Company.

Notwithstanding the foregoing, a transaction will not be deemed a Change in Control unless the transaction qualifies as a change in control event within the meaning of Code Section 409A, as it has been and may be amended from time to time, and any proposed or final Treasury Regulations and Internal Revenue Service guidance that has been promulgated or may be promulgated thereunder from time to time.

Further and for the avoidance of doubt, a transaction will not constitute a Change in Control if: (i) its sole purpose is to change the state of the Company's incorporation, or (ii) its sole purpose is to create a holding company that will be owned in substantially the same proportions by the persons who held the Company's securities immediately before such transaction.

(h) "Code" means the Internal Revenue Code of 1986, as amended. Reference to a specific section of the Code or regulation thereunder shall include such section or regulation, any valid regulation promulgated under such section, and any comparable provision of any future legislation or regulation amending, supplementing or superseding such section or regulation.

(i) "Committee" means a committee of Directors or of other individuals satisfying Applicable Laws appointed by the Board in accordance with Section 4 hereof.

(j) "Common Stock" means the common stock of the Company.

(k) "Company" means Fluidigm Corporation, a Delaware corporation, or any successor thereto.

(l) "Consultant" means any person, including an advisor, engaged by the Company or a Parent or Subsidiary to render services to such entity.

(m) "Director" means a member of the Board.

(n) "Disability" means total and permanent disability as defined in Section 22(e)(3) of the Code, provided that in the case of Awards other than Incentive Stock Options, the Administrator in its discretion may determine whether a permanent and total disability exists in accordance with uniform and non-discriminatory standards adopted by the Administrator from time to time.

(o) "Employee" means any person, including Officers and Directors, employed by the Company or any Parent or Subsidiary of the Company. Neither service as a Director nor payment of a director's fee by the Company will be sufficient to constitute "employment" by the Company.

(p) "Exchange Act" means the Securities Exchange Act of 1934, as amended.

(q) "Exchange Program" means a program under which (i) outstanding Awards are surrendered or cancelled in exchange for Awards of the same type (which may have higher or lower exercise prices and different terms), Awards of a different type, and/or cash, (ii) Participants would have the opportunity to transfer any outstanding Awards to a financial institution or other person or entity selected by the Administrator, and/or (iii) the exercise price of an outstanding Award is increased or reduced. The Administrator will determine the terms and conditions of any Exchange Program in its sole discretion.

(r) "Fair Market Value" means, as of any date, the value of Common Stock determined as follows:

(i) If the Common Stock is listed on any established stock exchange or a national market system, including without limitation the Nasdaq Global Select Market, the Nasdaq Global Market or the Nasdaq Capital Market of The Nasdaq Stock Market, its Fair Market Value will be the closing sales price for such stock (or the closing bid, if no sales were reported) as quoted on such exchange or system on the day of determination, as reported in *The Wall Street Journal* or such other source as the Administrator deems reliable. If there are no trades on such date, the closing price on the latest preceding business day upon which trades occurred shall be the Fair Market Value.

(ii) If the Common Stock is regularly quoted by a recognized securities dealer but selling prices are not reported, the Fair Market Value of a Share will be the mean between the high bid and low asked prices for the Common Stock on the day of determination, as reported in *The Wall Street Journal* or such other source as the Administrator deems reliable.

(iii) In the absence of an established market for the Common Stock, the Fair Market Value will be determined in good faith by the Administrator.

(s) "Fiscal Year" means the fiscal year of the Company.

(t) "Incentive Stock Option" means an Option intended to qualify as an incentive stock option within the meaning of Section 422 of the Code and the regulations promulgated thereunder.

(u) "Inside Director" means a Director who is an Employee.

(v) "Nonstatutory Stock Option" means an Option that by its terms does not qualify or is not intended to qualify as an Incentive Stock Option.

(w) "Officer" means a person who is an officer of the Company within the meaning of Section 16 of the Exchange Act and the rules and regulations promulgated thereunder.

(x) "Option" means a stock option granted pursuant to the Plan.

(y) "Outside Director" means a Director who is not an Employee.

(z) "Parent" means a "parent corporation," whether now or hereafter existing, as defined in Section 424(e) of the Code.

(aa) "Participant" means the holder of an outstanding Award.

(bb) "Performance Share" means an Award denominated in Shares which may be earned in whole or in part upon attainment of performance goals or other vesting criteria as the Administrator may determine pursuant to Section 10.

(cc) "Performance Unit" means an Award which may be earned in whole or in part upon attainment of performance goals or other vesting criteria as the Administrator may determine and which may be settled for cash, Shares or other securities or a combination of the foregoing pursuant to Section 10.

(dd) "Period of Restriction" means the period during which the transfer of Shares of Restricted Stock are subject to restrictions and therefore, the Shares are subject to a substantial risk of forfeiture. Such restrictions may be based on the passage of time, the achievement of target levels of performance, or the occurrence of other events as determined by the Administrator.

(ee) "Plan" means this 2011 Equity Incentive Plan, as amended and restated effective June 3, 2019, and as further amended at the 2020 Annual Meeting of Stockholders.

(ff) "Restricted Stock" means Shares issued pursuant to a Restricted Stock award under Section 7 of the Plan, or issued pursuant to the early exercise of an Option.

(gg) "Restricted Stock Unit" means a bookkeeping entry representing an amount equal to the Fair Market Value of one Share, granted pursuant to Section 8. Each Restricted Stock Unit represents an unfunded and unsecured obligation of the Company.

(hh) "Rule 16b-3" means Rule 16b-3 of the Exchange Act or any successor to Rule 16b-3, as in effect when discretion is being exercised with respect to the Plan.

(ii) "Section 16(b)" means Section 16(b) of the Exchange Act.

(jj) "Service Provider" means an Employee, Director or Consultant.

(kk) "Share" means a share of the Common Stock, as adjusted in accordance with Section 13 of the Plan.

(ll) "Stock Appreciation Right" means an Award, granted alone or in connection with an Option, that pursuant to Section 9 is designated as a Stock Appreciation Right.

(mm) "Subsidiary" means a "subsidiary corporation," whether now or hereafter existing, as defined in Section 424(f) of the Code.

3. Stock Subject to the Plan.

(a) Stock Subject to the Plan. Subject to the provisions of Section 13 of the Plan, the maximum aggregate number of Shares that may be issued under the Plan as of the Amendment Effective Date is (i) 1,420,000 Shares, plus (ii) any Shares that, as of immediately prior to the Amendment Effective Date, were available for grant under the pre-existing version of the 2011 Equity Incentive Plan prior to this amendment (the "Existing Plan"), with the maximum number of Shares to be added to the Plan pursuant to clause (ii) equal to 3,583,102 Shares. The Shares may be authorized, but unissued, or reacquired Common Stock.

(b) Lapsed Awards. If an Award expires or becomes unexercisable without having been exercised in full or, with respect to Restricted Stock, Restricted Stock Units, Performance Units or Performance Shares, is forfeited to or repurchased by the Company due to failure to vest, the unpurchased Shares (or for Awards other than Options or Stock Appreciation Rights the forfeited or repurchased Shares) which were subject thereto will become available for future grant or sale under the Plan (unless the Plan has terminated). With respect to Stock Appreciation Rights, only Shares actually issued (i.e., the net Shares issued) pursuant to a Stock Appreciation Right will cease to be available under the Plan; all remaining Shares under Stock Appreciation Rights will remain available for future grant or sale under the Plan (unless the Plan has terminated). Shares that have actually been issued under the Plan under any Award will not be returned to the Plan and will not become available for future distribution under the Plan; provided, however, that if Shares issued pursuant to Awards of Restricted Stock, Restricted Stock Units, Performance Shares or Performance Units are repurchased by the Company or are forfeited to the Company, such Shares will become available for future grant under the Plan. Shares used to pay the exercise price of an Award or to satisfy the tax withholding obligations related to an Award will become available for future grant or sale under the Plan. To the extent an Award under the Plan is paid out in cash rather than Shares, such cash payment will not result in reducing the number of Shares available for issuance under the Plan. Notwithstanding the foregoing and, subject to adjustment as provided in Section 13, the maximum number of Shares that may be issued upon the exercise of Incentive Stock Options will equal the aggregate Share number stated in Section 3(a), plus, to the extent allowable under Section 422 of the Code and the Treasury Regulations promulgated thereunder, any Shares that become available for issuance under the Plan pursuant to Sections 3(b) and 3(c).

(c) Share Reserve. The Company, during the term of this Plan, will at all times reserve and keep available such number of Shares as will be sufficient to satisfy the requirements of the Plan.

4. Administration of the Plan.

(a) Procedure.

(i) Multiple Administrative Bodies. Different Committees may administer the Plan with respect to different groups of Service Providers.

(ii) Rule 16b-3. To the extent desirable to qualify transactions hereunder as exempt under Rule 16b-3, such transactions will be structured to satisfy the requirements for exemption under Rule 16b-3.

(iii) Other Administration. Other than as provided above, the Plan will be administered by (A) the Board or (B) a Committee constituted to satisfy Applicable Laws.

(b) Powers of the Administrator. Subject to the provisions of the Plan, and in the case of a Committee, subject to the specific duties delegated by the Board to such Committee, the Administrator will have the authority, in its discretion:

(i) to determine the Fair Market Value;

(ii) to select the Service Providers to whom Awards may be granted hereunder;

(iii) to determine the number of Shares to be covered by each Award granted hereunder;

(iv) to approve forms of Award Agreements for use under the Plan;

(v) to determine the terms and conditions, not inconsistent with the terms of the Plan, of any Award granted hereunder. Such terms and conditions include, but are not limited to, the exercise price, the time or times when Awards may be exercised (which may be based on performance criteria), any vesting acceleration or waiver of forfeiture restrictions, and any restriction or limitation regarding any Award or the Shares relating thereto, based in each case on such factors as the Administrator will determine;

(vi) to construe and interpret the terms of the Plan and Awards granted pursuant to the Plan;

(vii) to prescribe, amend and rescind rules and regulations relating to the Plan, including rules and regulations relating to sub-plans established for the purpose of satisfying applicable foreign laws or for qualifying for favorable tax treatment under applicable foreign laws;

(viii) to modify or amend each Award (subject to Section 18 of the Plan), including but not limited to the discretionary authority to extend the post-termination exercisability period of Awards and to extend the maximum term of an Option (subject to Section 6(b) of the Plan);

(ix) to allow Participants to satisfy tax withholding obligations in such manner as prescribed in Section 14 of the Plan;

(x) to authorize any person to execute on behalf of the Company any instrument required to effect the grant of an Award previously granted by the Administrator;

(xi) to allow a Participant to defer the receipt of the payment of cash or the delivery of Shares that would otherwise be due to such Participant under an Award; and

(xii) to make all other determinations deemed necessary or advisable for administering the Plan.

(c) Effect of Administrator's Decision. The decisions, determinations, and interpretations of the Administrator will be final and binding on all Participants and any other holders of Awards.

(d) Limitations on Administrative Authority. Notwithstanding anything herein to the contrary, the Administrator shall be limited as follows:

(i) Exchange Program. The Administrator may not implement an Exchange Program.

(ii) No Dividends or Dividend Equivalents Paid on Unvested Awards. No dividends or dividend equivalents shall be paid on any unvested Awards. Any dividends or dividend equivalents may be declared or accrue on unvested Awards, but shall not be paid until the vesting of such Awards.

(iii) Outside Director Limitations. No Outside Director may be paid, issued or granted, in any Fiscal Year, Awards with an aggregate value greater than $400,000 (with the value of each Award based on its grant date fair value (determined in accordance with U.S. generally accepted accounting principles)), except that such limit will be increased to $500,000 in the Fiscal Year of his or her initial service as an Outside Director. Any Awards granted to an individual for his or her services as an Employee, or for his or her services as a Consultant (other than as an Outside Director), will not count for purposes of the limitation under this Section 4(d)(iii).

5. Eligibility. Nonstatutory Stock Options, Stock Appreciation Rights, Restricted Stock, Restricted Stock Units, Performance Shares and Performance Units may be granted to Service Providers. Incentive Stock Options may be granted only to Employees.

6. Stock Options.

(a) Limitations. Each Option will be designated in the Award Agreement as either an Incentive Stock Option or a Nonstatutory Stock Option. However, notwithstanding such designation, to the extent that the aggregate Fair Market Value of the Shares with respect to which Incentive Stock Options are exercisable for the first time by the Participant during any calendar year (under all plans of the Company and any Parent or Subsidiary) exceeds one hundred thousand dollars ($100,000), such Options will be treated as Nonstatutory Stock Options. For purposes of this Section 6(a), Incentive Stock Options will be taken into account in the order in which they were granted. The Fair Market Value of the Shares will be determined as of the time the Option with respect to such Shares is granted.

(b) Term of Option. The term of each Option will be stated in the Award Agreement. In the case of any Option (whether Incentive Stock Option or Nonstatutory Stock Option), the maximum term will be ten (10) years from the date of grant or such shorter term as may be provided in the Award Agreement. Moreover, in the case of an Incentive Stock Option granted to a Participant who, at the time the Incentive Stock Option is granted, owns stock representing more than ten percent (10%) of the total combined voting power of all classes of stock of the Company or any Parent or Subsidiary, the term of the Incentive Stock Option will be five (5) years from the date of grant or such shorter term as may be provided in the Award Agreement.

(c) Option Exercise Price and Consideration.

(i) Exercise Price. The per share exercise price for the Shares to be issued pursuant to exercise of an Option will be determined by the Administrator, subject to the following:

(1) In the case of an Incentive Stock Option

a) granted to an Employee who, at the time the Incentive Stock Option is granted, owns stock representing more than ten percent (10%) of the voting power of all classes of stock of the Company or any Parent or Subsidiary, the per Share exercise price will be no less than one hundred ten percent (110%) of the Fair Market Value per Share on the date of grant.

b) granted to any Employee other than an Employee described in paragraph (A) immediately above, the per Share exercise price will be no less than one hundred percent (100%) of the Fair Market Value per Share on the date of grant.

(2) In the case of a Nonstatutory Stock Option, the per Share exercise price will be no less than one hundred percent (100%) of the Fair Market Value per Share on the date of grant.

(3) Notwithstanding the foregoing, Options may be granted with a per Share exercise price of less than one hundred percent (100%) of the Fair Market Value per Share on the date of grant pursuant to a transaction described in, and in a manner consistent with, Section 424(a) of the Code.

(ii) Waiting Period and Exercise Dates. At the time an Option is granted, the Administrator will fix the period within which the Option may be exercised and will determine any conditions that must be satisfied before the Option may be exercised.

(iii) Form of Consideration. The Administrator will determine the acceptable form of consideration for exercising an Option, including the method of payment. In the case of an Incentive Stock Option, the Administrator will determine the acceptable form of consideration at the time of grant. Such consideration may consist entirely of: (1) cash; (2) check; (3) other Shares, provided that such Shares have a Fair Market Value on the date of surrender equal to the aggregate exercise price of the Shares as to which such Option will be exercised and provided that accepting such Shares will not result in any adverse accounting consequences to the Company, as the Administrator may determine in its sole discretion; (4) consideration received by the Company under a broker-assisted (or other) cashless exercise program (whether through a broker or otherwise) implemented by the Company in connection with the Plan; (5) by net exercise; (6) such other consideration and method of payment for the issuance of Shares to the extent permitted by Applicable Laws; or (7) any combination of the foregoing methods of payment.

(d) Exercise of Option.

(i) Procedure for Exercise; Rights as a Stockholder. Any Option granted hereunder will be exercisable according to the terms of the Plan and at such times and under such conditions as determined by the Administrator and set forth in the Award Agreement. An Option may not be exercised for a fraction of a Share.

An Option will be deemed exercised when the Company receives: (i) notice of exercise (in such form as the Administrator may specify from time to time) from the person entitled to exercise the Option, and (ii) full payment for the Shares with respect to which the Option is exercised (together with applicable withholding taxes). Full payment may consist of any consideration and method of payment authorized by the Administrator and permitted by the Award Agreement and the Plan. Shares issued upon exercise of an Option will be issued in the name of the Participant or, if requested by the Participant, in the name of the Participant and his or her spouse. Until the Shares are issued (as evidenced by the appropriate entry on the books of the Company or of a duly authorized transfer agent of the Company), no right to vote or receive dividends or any other rights as a stockholder will exist with respect to the Shares subject to an Option, notwithstanding the exercise of the Option. The Company will issue (or cause to be issued) such Shares promptly after the Option is exercised. No adjustment will be made for a dividend or other right for which the record date is prior to the date the Shares are issued, except as provided in Section 13 of the Plan.

Exercising an Option in any manner will decrease the number of Shares thereafter available, both for purposes of the Plan and for sale under the Option, by the number of Shares as to which the Option is exercised.

(ii) Termination of Relationship as a Service Provider. If a Participant ceases to be a Service Provider, other than upon the Participant's termination as the result of the Participant's death or Disability, the Participant may exercise his or her Option within such period of time as is specified in the Award Agreement to the extent that the Option is vested on the date of termination (but in no event later than the expiration of the term of such Option as set forth in the Award Agreement). In the absence of a specified time in the Award Agreement, the Option will remain exercisable for three (3) months following the Participant's termination. Unless otherwise provided by the Administrator, if on the date of termination the Participant is not vested as to his or her entire Option, the Shares covered by the unvested portion of the Option will revert to the Plan. If after termination the Participant does not exercise his or her Option within the time specified by the Administrator, the Option will terminate, and the Shares covered by such Option will revert to the Plan.

(iii) Disability of Participant. If a Participant ceases to be a Service Provider as a result of the Participant's Disability, the Participant may exercise his or her Option within such period of time as is specified in the Award Agreement to the extent the Option is vested on the date of termination (but in no event later than the expiration of the term of such Option as set forth in the Award Agreement). In the absence of a specified time in the Award Agreement, the Option will remain exercisable for twelve (12) months following the Participant's termination. Unless otherwise provided by the Administrator, if on the date of termination the Participant is not vested as to his or her entire Option, the Shares covered by the unvested portion of the Option will revert to the Plan. If after termination the Participant does not exercise his or her Option within the time specified herein, the Option will terminate, and the Shares covered by such Option will revert to the Plan.

(iv) Death of Participant. If a Participant dies while a Service Provider, the Option may be exercised following the Participant's death within such period of time as is specified in the Award Agreement to the extent that the Option is vested on the date of death (but in no event may the option be exercised later than the expiration of the term of such Option as set forth in the Award Agreement), by the Participant's designated beneficiary, provided such beneficiary has been designated prior to Participant's death in a form acceptable to the Administrator. If no such beneficiary has been designated by the Participant, then such Option may be exercised by the personal representative of the Participant's estate or by the person(s) to whom the Option is transferred pursuant to the Participant's will or in accordance with the laws of descent and distribution. In the absence of a specified time in the Award Agreement, the Option will remain exercisable for twelve (12) months following Participant's death. Unless otherwise provided by the Administrator, if at the time of death Participant is not vested as to his or her entire Option, the Shares covered by the unvested portion of the Option will immediately revert to the Plan. If the Option is not so exercised within the time specified herein, the Option will terminate, and the Shares covered by such Option will revert to the Plan.

7. Restricted Stock.

(a) Grant of Restricted Stock. Subject to the terms and provisions of the Plan, the Administrator, at any time and from time to time, may grant Shares of Restricted Stock to Service Providers in such amounts as the Administrator, in its sole discretion, will determine.

(b) Restricted Stock Agreement. Each Award of Restricted Stock will be evidenced by an Award Agreement that will specify the Period of Restriction, the number of Shares granted, and such other terms and conditions as the Administrator, in its sole discretion, will determine. Unless the Administrator determines otherwise, the Company as escrow agent will hold Shares of Restricted Stock until the restrictions on such Shares have lapsed.

(c) Transferability. Except as provided in this Section 7 or in the Award Agreement, Shares of Restricted Stock may not be sold, transferred, pledged, assigned, or otherwise alienated or hypothecated until the end of the applicable Period of Restriction.

(d) Other Restrictions. The Administrator, in its sole discretion, may impose such other restrictions on Shares of Restricted Stock as it may deem advisable or appropriate.

(e) Removal of Restrictions. Except as otherwise provided in this Section 7, Shares of Restricted Stock covered by each Restricted Stock grant made under the Plan will be released from escrow as soon as practicable after the last day of the Period of Restriction or at such other time as the Administrator may determine. The Administrator, in its discretion, may accelerate the time at which any restrictions will lapse or be removed.

(f) Voting Rights. During the Period of Restriction, Service Providers holding Shares of Restricted Stock granted hereunder may exercise full voting rights with respect to those Shares, unless the Administrator determines otherwise.

(g) Dividends and Other Distributions. During the Period of Restriction, Service Providers holding Shares of Restricted Stock will be entitled to receive all dividends and other distributions paid with respect to such Shares, unless the Administrator provides otherwise, subject to Section 4(d)(ii). If any such dividends or distributions are paid in Shares, the Shares will be subject to the same restrictions on transferability and forfeitability as the Shares of Restricted Stock with respect to which they were paid.

(h) Return of Restricted Stock to Company. On the date set forth in the Award Agreement, the Restricted Stock for which restrictions have not lapsed will revert to the Company and again will become available for grant under the Plan.

8. Restricted Stock Units.

(a) Grant. Restricted Stock Units may be granted at any time and from time to time as determined by the Administrator. After the Administrator determines that it will grant Restricted Stock Units under the Plan, it will advise the Participant in an Award Agreement of the terms, conditions, and restrictions related to the grant, including the number of Restricted Stock Units.

(b) Vesting Criteria and Other Terms. The Administrator will set vesting criteria in its discretion, which, depending on the extent to which the criteria are met, will determine the number of Restricted Stock Units that will be paid out to the Participant. The Administrator may set vesting criteria based upon the achievement of Company-wide, business unit, or individual goals (including, but not limited to, continued employment), or any other basis determined by the Administrator in its discretion.

(c) Earning Restricted Stock Units. Upon meeting the applicable vesting criteria, the Participant will be entitled to receive a payout as determined by the Administrator. Notwithstanding the foregoing, at any time after the grant of Restricted Stock Units, the Administrator, in its sole discretion, may reduce or waive any vesting criteria that must be met to receive a payout.

(d) Form and Timing of Payment. Payment of earned Restricted Stock Units will be made as soon as practicable after the date(s) determined by the Administrator and set forth in the Award Agreement. The Administrator, in its sole discretion, may only settle earned Restricted Stock Units in cash, Shares, or a combination of both.

(e) Cancellation. On the date set forth in the Award Agreement, all unearned Restricted Stock Units will be forfeited to the Company.

9. Stock Appreciation Rights.

(a) Grant of Stock Appreciation Rights. Subject to the terms and conditions of the Plan, a Stock Appreciation Right may be granted to Service Providers at any time and from time to time as will be determined by the Administrator, in its sole discretion.

(b) Number of Shares. The Administrator will have complete discretion to determine the number of Stock Appreciation Rights granted to any Service Provider.

(c) Exercise Price and Other Terms. The per share exercise price for the Shares to be issued pursuant to exercise of a Stock Appreciation Right will be determined by the Administrator and will be no less than one hundred percent (100%) of the Fair Market Value per Share on the date of grant. Otherwise, subject to Section 6(a) of the Plan, the Administrator, subject to the provisions of the Plan, will have complete discretion to determine the terms and conditions of Stock Appreciation Rights granted under the Plan; provided, that the maximum term of any Stock Appreciation Right will be ten (10) years from the date of grant.

(d) Stock Appreciation Right Agreement. Each Stock Appreciation Right grant will be evidenced by an Award Agreement that will specify the exercise price, the term of the Stock Appreciation Right, the conditions of exercise, and such other terms and conditions as the Administrator, in its sole discretion, will determine.

(e) Expiration of Stock Appreciation Rights. A Stock Appreciation Right granted under the Plan will expire upon the date determined by the Administrator, in its sole discretion, and set forth in the Award Agreement. Notwithstanding the foregoing, the rules of Section 6(b) relating to the maximum term and Section 6(d) relating to exercise also will apply to Stock Appreciation Rights.

(f) Payment of Stock Appreciation Right Amount. Upon exercise of a Stock Appreciation Right, a Participant will be entitled to receive payment from the Company in an amount determined by multiplying (i) the difference between the Fair Market Value of a Share on the date of exercise over the exercise price times (ii) the number of Shares with respect to which the Stock Appreciation Right is exercised. At the discretion of the Administrator, the payment upon exercise of a Stock Appreciation Right may be made in cash, in Shares of equivalent value, or in some combination thereof.

10. Performance Units and Performance Shares.

(a) Grant of Performance Units/Shares. Performance Units and Performance Shares may be granted to Service Providers at any time and from time to time, as will be determined by the Administrator, in its sole discretion. The Administrator will have complete discretion in determining the number of Performance Units and Performance Shares granted to each Participant.

(b) Value of Performance Units/Shares. Each Performance Unit will have an initial value that is established by the Administrator on or before the date of grant. Each Performance Share will have an initial value equal to the Fair Market Value of a Share on the date of grant.

(c) Performance Objectives and Other Terms. The Administrator will set performance objectives or other vesting provisions (including, without limitation, continued status as a Service Provider) in its discretion which, depending on the extent to which they are met, will determine the number or value of Performance Units/Shares that will be paid out to the Service Providers. The time period during which the performance objectives or other vesting provisions must be met will be called the "Performance Period." Each Award of Performance Units/Shares will be evidenced by an Award Agreement that will specify the Performance Period, and such other terms and conditions as the Administrator, in its sole discretion, will determine. The Administrator may set performance objectives based upon the achievement of Company-wide, divisional, or individual goals, applicable federal or state securities laws, or any other basis determined by the Administrator in its discretion.

(d) Earning of Performance Units/Shares. After the applicable Performance Period has ended, the holder of Performance Units/Shares will be entitled to receive a payout of the number of Performance Units/Shares earned by the Participant over the Performance Period, to be determined as a function of the extent to which the corresponding performance objectives or other vesting provisions have been achieved. After the grant of a Performance Unit/Share, the

Administrator, in its sole discretion, may reduce or waive any performance objectives or other vesting provisions for such Performance Unit/Share.

(e) Form and Timing of Payment of Performance Units/Shares. Payment of earned Performance Units/Shares will be made as soon as practicable after the expiration of the applicable Performance Period. The Administrator, in its sole discretion, may pay earned Performance Units/Shares in the form of cash, in Shares (which have an aggregate Fair Market Value equal to the value of the earned Performance Units/Shares at the close of the applicable Performance Period) or in a combination thereof.

(f) Cancellation of Performance Units/Shares. On the date set forth in the Award Agreement, all unearned or unvested Performance Units/Shares will be forfeited to the Company, and again will be available for grant under the Plan.

11. Leaves of Absence/Transfers Between Locations. Unless the Administrator provides otherwise, vesting of Awards granted hereunder will be suspended during any unpaid leave of absence. A Participant will not cease to be an Employee in the case of (i) any leave of absence approved by the Company or (ii) transfers between locations of the Company or between the Company, its Parent, or any Subsidiary. For purposes of Incentive Stock Options, no such leave may exceed three (3) months, unless reemployment upon expiration of such leave is guaranteed by statute or contract. If reemployment upon expiration of a leave of absence approved by the Company is not so guaranteed, then six (6) months following the first day of such leave any Incentive Stock Option held by the Participant will cease to be treated as an Incentive Stock Option and will be treated for tax purposes as a Nonstatutory Stock Option.

12. Transferability of Awards. Unless determined otherwise by the Administrator, an Award may not be sold, pledged, assigned, hypothecated, transferred, or disposed of in any manner other than by will or by the laws of descent or distribution and may be exercised, during the lifetime of the Participant, only by the Participant. If the Administrator makes an Award transferable, such Award will contain such additional terms and conditions as the Administrator deems appropriate; provided that no Award shall be transferred for value or consideration.

13. Adjustments; Dissolution or Liquidation; Merger or Change in Control.

(a) Adjustments. In the event that any dividend or other distribution (whether in the form of cash, Shares, other securities, or other property), recapitalization, stock split, reverse stock split, reorganization, merger, consolidation, split-up, spin-off, combination, repurchase, or exchange of Shares or other securities of the Company, or other change in the corporate structure of the Company affecting the Shares occurs, the Administrator, in order to prevent diminution or enlargement of the benefits or potential benefits intended to be made available under the Plan, will adjust the number and class of Shares that may be delivered under the Plan and/or the number, class, and price of Shares covered by each outstanding Award, and the numerical Share limits in Section 3 of the Plan.

(b) Dissolution or Liquidation. In the event of the proposed dissolution or liquidation of the Company, the Administrator will notify each Participant as soon as practicable prior to the effective date of such proposed transaction. To the extent it has not been previously exercised, an Award will terminate immediately prior to the consummation of such proposed action.

(c) Change in Control. In the event of a merger or Change in Control, each outstanding Award will be treated in accordance with this Section 13(c) or as provided in an Award Agreement, including, without limitation, that each Award be assumed or an equivalent option or right substituted by the successor corporation or a Parent or Subsidiary of the successor corporation. The Administrator will not be required to treat all Awards similarly in the transaction.

In the event that the successor corporation does not assume or substitute for the Award, the Participant will fully vest in and have the right to exercise all of his or her outstanding Options and Stock Appreciation Rights, including Shares as to which such Awards would not otherwise be vested or exercisable, all restrictions on Restricted Stock and Restricted Stock Units will lapse, and, with respect to Awards with performance-based vesting, all performance goals or other vesting criteria will be deemed achieved at one hundred percent (100%) of target levels and all other terms and conditions met. In addition, if an Option or Stock Appreciation Right is not assumed or substituted in the event of a Change in Control, the Administrator will notify the Participant in writing or electronically that the Option or Stock Appreciation Right will be exercisable for a period of time determined by the Administrator in its sole discretion, and the Option or Stock Appreciation Right will terminate upon the expiration of such period.

For the purposes of this subsection (c), an Award will be considered assumed if, following the Change in Control, the Award confers the right to purchase or receive, for each Share subject to the Award immediately prior to the Change in Control, the consideration (whether stock, cash, or other securities or property) received in the Change in Control by holders of Common Stock for each Share held on the effective date of the transaction (and if holders were offered a choice of consideration, the type of consideration chosen by the holders of a majority of the outstanding Shares); provided, however, that if such consideration received in the Change in Control is not solely common stock of the successor corporation or its Parent, the Administrator may, with the consent of the successor corporation, provide for the consideration to be received upon the exercise of an Option or Stock Appreciation Right or upon the payout of a Restricted Stock Unit, Performance Unit or Performance Share, for each Share subject to such Award, to be solely common stock of the successor corporation or its Parent equal in fair market value to the per share consideration received by holders of Common Stock in the Change in Control.

Notwithstanding anything in this Section 13(c) to the contrary, an Award that vests, is earned or paid-out upon the satisfaction of one or more performance goals will not be considered assumed if the Company or its successor modifies any of such performance goals without the Participant's consent; provided, however, a modification to such performance goals only to reflect the successor corporation's post-Change in Control corporate structure will not be deemed to invalidate an otherwise valid Award assumption.

(d) Outside Director Awards. With respect to Awards granted to an Outside Director that are assumed or substituted for, if on the date of or following such assumption or substitution the Participant's status as a Director or a director of the successor corporation, as applicable, is terminated other than upon a voluntary resignation by the Participant (unless such resignation is at the request of the acquirer), then the Participant will fully vest in and have the right to exercise Options and/or Stock Appreciation Rights as to all of the Shares underlying such Award, including those Shares which would not otherwise be vested or exercisable, all restrictions on Restricted Stock and Restricted Stock Units will lapse, and, with respect to Performance Units and Performance Shares, all performance goals or other vesting criteria will be deemed achieved at one hundred percent (100%) of target levels and all other terms and conditions met.

14. Tax.

(a) Withholding Requirements. Prior to the delivery of any Shares or cash pursuant to an Award (or exercise thereof), the Company will have the power and the right to deduct or withhold, or require a Participant to remit to the Company, an amount sufficient to satisfy federal, state, local, foreign or other taxes (including the Participant's FICA obligation) required to be withheld with respect to such Award (or exercise thereof).

(b) Withholding Arrangements. The Administrator, in its sole discretion and pursuant to such procedures as it may specify from time to time, may permit a Participant to satisfy such tax withholding obligation, in whole or in part by (without limitation) (a) paying cash, (b) electing to have the Company withhold otherwise deliverable cash or Shares having a fair market value not in excess of the maximum statutory amount required to be withheld, or (c) delivering to the Company already-owned shares having a fair market value not in excess of the maximum statutory amount required to be withheld. the fair market value of the shares to be withheld or delivered will be determined as of the date that the taxes are required to be withheld.

(c) Compliance With Code Section 409A. Awards will be designed and operated in such a manner that they are either exempt from the application of, or comply with, the requirements of Code Section 409A such that the grant, payment, settlement or deferral will not be subject to the additional tax or interest applicable under Code Section 409A, except as otherwise determined in the sole discretion of the Administrator. The Plan and each Award Agreement under the Plan is intended to meet the requirements of Code Section 409A and will be construed and interpreted in accordance with such intent, except as otherwise determined in the sole discretion of the Administrator. To the extent that an Award or payment, or the settlement or deferral thereof, is subject to Code Section 409A the Award will be granted, paid, settled or deferred in a manner that will meet the requirements of Code Section 409A, such that the grant, payment, settlement or deferral will not be subject to the additional tax or interest applicable under Code Section 409A.

15. No Effect on Employment or Service. Neither the Plan nor any Award will confer upon a Participant any right with respect to continuing the Participant's relationship as a Service Provider with the Company, nor will they interfere in any way with the Participant's right or the Company's right to terminate such relationship at any time, with or without cause, to the extent permitted by Applicable Laws.

16. Date of Grant. The date of grant of an Award will be, for all purposes, the date on which the Administrator makes the determination granting such Award, or such other later date as is determined by the Administrator. Notice of the determination will be provided to each Participant within a reasonable time after the date of such grant.

17. Term of Plan. Subject to Section 22 of the Plan, the Plan will become effective upon the Amendment Effective Date. It will continue in effect for a term of ten (10) years from the date the Existing Plan was adopted by the Board, unless terminated earlier under Section 18 of the Plan.

18. Amendment and Termination of the Plan.

(a) Amendment and Termination. The Board may at any time amend, alter, suspend or terminate the Plan.

(b) Stockholder Approval. The Company will obtain stockholder approval of any Plan amendment to the extent necessary and desirable to comply with Applicable Laws.

(c) Effect of Amendment or Termination. No amendment, alteration, suspension or termination of the Plan will impair the rights of any Participant, unless mutually agreed otherwise between the Participant and the Administrator, which agreement must be in writing and signed by the Participant and the Company. Termination of the Plan will not affect the Administrator's ability to exercise the powers granted to it hereunder with respect to Awards granted under the Plan prior to the date of such termination.

19. Conditions Upon Issuance of Shares.

(a) Legal Compliance. Shares will not be issued pursuant to the exercise of an Award unless the exercise of such Award and the issuance and delivery of such Shares will comply with Applicable Laws and will be further subject to the approval of counsel for the Company with respect to such compliance.

(b) Investment Representations. As a condition to the exercise of an Award, the Company may require the person exercising such Award to represent and warrant at the time of any such exercise that the Shares are being purchased only for investment and without any present intention to sell or distribute such Shares if, in the opinion of counsel for the Company, such a representation is required.

20. Inability to Obtain Authority. The inability of the Company to obtain authority from any regulatory body having jurisdiction, which authority is deemed by the Company's counsel to be necessary to the lawful issuance and sale of any Shares hereunder, will relieve the Company of any liability in respect of the failure to issue or sell such Shares as to which such requisite authority will not have been obtained.

21. Forfeiture Events.

(a) All Awards under the Plan will be subject to recoupment under the Company's current Clawback Policy and any clawback policy that the Company is required to adopt pursuant to the listing standards of any national securities exchange or association on which the Company's securities are listed or as is otherwise required by the Dodd-Frank Wall Street Reform and Consumer Protection Act or other Applicable Laws. In addition, the Administrator may impose such other clawback, recovery or recoupment provisions in an Award Agreement as the Administrator determines necessary or appropriate, including but not limited to a reacquisition right regarding previously acquired Shares or other cash or property. Unless this Section 21(a) is specifically mentioned and waived in an Award Agreement or other document, no recovery of compensation under a clawback policy or otherwise will be an event that triggers or contributes to any right of a Participant to resign for "good reason" or "constructive termination" (or similar term) under any agreement with the Company or a Subsidiary, Parent, or affiliate of the Company.

(b) The Administrator may specify in an Award Agreement that the Participant's rights, payments, and benefits with respect to an Award will be subject to reduction, cancellation, forfeiture, or recoupment upon the occurrence of specified events, in addition to any otherwise applicable vesting or performance conditions of an Award. Such events may include, but will not be limited to, termination of such Participant's status as Service Provider for cause or any specified action or inaction by a Participant, whether before or after such termination of service, that would constitute cause for termination of such Participant's status as a Service Provider.

22. Stockholder Approval. This amendment of the Plan is subject to, and contingent upon, stockholder approval at the 2020 Annual Meeting of Stockholders. Such stockholder approval will be obtained in the manner and to the degree required under Applicable Laws.

BOARD OF DIRECTORS AND MANAGEMENT

Directors

Carlos Paya, M.D., Ph.D., *Chairman*
Former Chief Executive Officer, President and Director, Immune Design Corp.

Nicolas Barthelemy
Former President and Chief Executive Officer, Biotheranostics, Inc.

Gerhard F. Burbach
Former President, Chief Executive Officer, and Director, Thoratec Corporation

Laura M. Clague
Senior Vice President and Chief Financial Officer, Retrophin, Inc.

Samuel D. Colella,
Managing Director, Versant Ventures; General Partner, Institutional Venture Partners

Bill W. Colston, Ph.D.
President and Director, iCarbonX Inc.

Patrick S. Jones
Private investor

Stephen Christopher Linthwaite
President and Chief Executive Officer

Executive Officers

Stephen Christopher Linthwaite
President and Chief Executive Officer

Vikram Jog
Chief Financial Officer

Nicholas Khadder
Senior Vice President, General Counsel, and Corporate Secretary

Bradley Kreger
Senior Vice President, Global Operations

Colin McCracken
Chief Commercial Officer

CORPORATE INFORMATION

Corporate Headquarters

Fluidigm Corporation
2 Tower Place
Suite 2000
South San Francisco, California 94080

Annual Meeting

Fluidigm's 2020 Annual Meeting of Stockholders will take place on Tuesday, June 23, 2020 at 8:30 a.m., Pacific time, at the Company's offices located at 2 Tower Place, Suite 2000, South San Francisco, California 94080.

Note: Due to the impact of COVID-19 and to protect the health and safety of our employees, directors, and stockholders, Fluidigm's Board may choose to hold its 2020 Annual Meeting solely via remote communications. Should the decision be made to hold the Annual Meeting remotely, we will announce the decision in advance, and details on how to participate will be set forth via a press release that will be filed with the Securities and Exchange Commission and available on our website at http://investors.fluidigm.com.

Independent Auditors

PricewaterhouseCoopers, LLP
San Jose, California

Legal Counsel

Wilson Sonsini Goodrich & Rosati, P.C.
Palo Alto, California

Stockholder Services

You may contact our transfer agent by writing Computershare at 462 South 4th Street, Suite 1600 Louisville, KY 40202. You may also contact our transfer agent by calling (800) 662-7232 or (781) 575-2879 or via its Investor Center at www-us.computershare.com/Investor/Contact.

Stock Exchange Information

Our common stock is traded on the Nasdaq Global Select Market under the symbol FLDM.

Internet Address Information

Visit us online at www.fluidigm.com for more information about us and our products and services. The 2019 Annual Report and the 2020 Proxy Statement are available online by visiting www.proxyvote.com and typing in the control number as set forth either on the proxy card as to stockholders of record, or on the voting instruction form as to individuals who hold shares through a broker, bank, trustee, or other nominee.

ANNUAL REPORT ON FORM 10-K

Stockholders may receive a copy of our annual report on Form 10-K, including the financial statements and the financial statement schedules, free of charge upon written request. Please send such requests to Fluidigm Corporation, 2 Tower Place, Suite 2000, South San Francisco, California 94080, Attention: Corporate Secretary.

Special Note Regarding Forward-Looking Statements

This Annual Report and the accompanying CEO letter contain forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, or Securities Act, and Section 21E of the Securities Exchange Act of 1934, as amended, or Exchange Act, that are based on our management's beliefs and assumptions and on information currently available to our management. The forward-looking statements are contained principally in the sections of our Annual Report entitled "Business," "Risk factors," and "Management's discussion and analysis of financial condition and results of operations." Forward-looking statements include information concerning our possible or assumed future cash flow, revenue, sources of revenue and results of operations, cost of product revenue and product margin, operating and other expenses, unit sales and the selling prices of our products, business strategies, financing plans, expansion of our business, competitive position, industry environment, potential growth opportunities, market growth expectations, and the effects of competition and public health crises (including COVID-19) on our business. Forward-looking statements include statements that are not historical facts and can be identified by terms such as "anticipates," "believes," "could," "seeks," "estimates," "expects," "intends," "may," "plans," "potential," "predicts, "projects," "should," "will," "would," or similar expressions and the negatives of those terms.

Forward-looking statements are subject to numerous risks and uncertainties that could cause our actual results, performance, or achievements to be materially different from any future results, performance, or achievements expressed or implied by the forward-looking statements. Given these uncertainties, you should not place undue reliance on these forward-looking statements. Factors that could materially affect our future results, performance, or achievements include, but are not limited to, the potential adverse effects of the COVID-19 pandemic on our business and operating results; interruptions or delays in the supply of components or materials for, or manufacturing of, our products resulting from the pandemic or other factors; challenges inherent in developing, manufacturing, launching, marketing, and selling new products; risks relating to reliance on sales of capital equipment for a significant proportion of revenues in each quarter; potential product performance and quality issues; the possible loss of key employees, customers, or suppliers; intellectual property risks; competition; uncertainties in contractual relationships; risks relating to company research and development, sales, marketing, and distribution plans and capabilities; reductions in research and development spending or changes in budget priorities by customers; seasonal variations in customer operations; unanticipated increases in costs or expenses; and risks associated with international operations. In addition, investors in Fluidigm should review the more detailed discussions of additional risks and uncertainties and other information affecting our business described under the caption "Risk factors" in our Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 27, 2020 and in our subsequent quarterly reports on Form 10-Q.

Except as required by law, we assume no obligation to update these forward-looking statements publicly, or to update the reasons actual results could differ materially from those anticipated in these forward-looking statements, even if new information becomes available in the future.

Fluidigm Corporation
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